

# ANNUAL REPORT 2018



AITHM | AUSTRALIAN INSTITUTE  
OF TROPICAL HEALTH & MEDICINE

AITHM gratefully acknowledges the funds received from the Queensland Government, the Commonwealth Government through the Australian Research Council Special Research Initiative (ARC SRI), and the Division of Tropical Health and Medicine (DTHM) at James Cook University (JCU). This funding enables AITHM to build essential research capacity in tropical health and medicine for Australia and the region.

We acknowledge the traditional custodians of the land on which AITHM facilities operate – the Bindal and Wulgurukaba (Townsville), Yirrganydji (Cairns), Kaurareg (Thursday Island) and Yuibera (Mackay) peoples - and pay our respects to all Elders, past, present and future.



**Australian Government**



**Queensland  
Government**



**JAMES COOK  
UNIVERSITY**  
AUSTRALIA





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AITHM researchers work in hospitals, in communities, in the field, in industry and development and in partnership with Aboriginal and Torres Strait Islander researchers. We share a selection of stories of our researchers' discoveries and achievements throughout these diverse settings in 2018.



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Years of planning, construction and certification came together in 2018 when official opening ceremonies were held for AITHM's newest research facilities in Cairns and on Thursday Island in the Torres Strait. These two new facilities add to the existing AITHM facilities in Townsville, Cairns and Mackay, including the new facility opened in Townsville in 2016.



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## Our Governance and Finance

The AITHM Advisory Board oversees the progress of AITHM and advises the Institute on ways that it might develop its research and business agenda. The Management Advisory Committee provides advice to AITHM management regarding key issues pertaining to the Institute's activities, operations, management and research program direction.

**ASPIRATION** | TO BE A GLOBAL LEADER IN TROPICAL HEALTH AND MEDICINE RESEARCH, DELIVERING POSITIVE REAL-WORLD SOCIAL AND ECONOMIC IMPACT

**MISSION** | TO DISCOVER AND DEVELOP HEALTH SOLUTIONS - FOR THE TROPICS AND FROM THE TROPICS



# ABOUT US

The Australian Institute of Tropical Health and Medicine (AITHM) is Australia's only dedicated tropical health and medicine research institute, and is focussed on improving the health of people in Northern Australia and our neighbouring tropical nations.

The Institute's research programs confront tropical Australia's major health security risks, tackle its worst health outcomes and contribute to the development of better ways to deliver health services to remote communities. AITHM contributes to the development of Northern Australia more broadly through building the knowledge industry, economic activity, infrastructure and commercialisation of research findings.

Wholly based in the Tropics, with facilities in Cairns, Townsville, Mackay and Thursday Island in the Torres Strait, AITHM has unprecedented access to, and connection with, the populations and clinicians who bear the burden of tropical health issues in Northern Australia. We understand the Tropics because we live and work in the Tropics.

As a flagship research institute of James Cook University (JCU), AITHM plays a key role in the education of the next generation of health and medical researchers by employing a collaborative research-driven approach to health and medical issues, building research capacity among health professionals, and training and educating clinicians and communities in tropical health.

## WHY IS TROPICAL HEALTH RESEARCH IMPORTANT?

It is predicted that more than 50 per cent of the world's population will live in the Tropics by 2050. There are distinct health and medical challenges pertaining to life in tropical regions, and demand for tropical health solutions will rise significantly in the coming decades.

The World Health Organisation (WHO) believes a new world infectious disease pandemic is inevitable and is likely to emerge from the Indo-Pacific region. The porous border between Papua New Guinea and Northern Australia is vulnerable and requires heightened vigilance to protect people from the risk of transmission of infectious disease. Increased air travel and movement of populations increases health security risks both for Australia and for other tropical nations. Ecological disruption associated with deforestation and changing agricultural practices, especially in East and South East Asia, increases the risk of new diseases being transmitted from wild animals into livestock and humans.

People living in Australia's tropical north bear a distinctive health burden that differs from their southern counterparts including a higher risk of infectious and mosquito-borne diseases, higher instances of many chronic health conditions, particularly in Indigenous populations, and the challenge of delivering health care and retaining a skilled health workforce to serve a widely dispersed population across rural and remote areas.

AITHM believes that the people of Northern Australia and the Tropics deserve innovative health solutions and systems tailored to the distinctive health care issues they face. While our principal focus is on the health issues of the Tropics, many of the solutions we find have broader application and also benefit other populations globally.



# DIRECTOR'S MESSAGE



Distinguished  
Professor Louis  
Schofield  
DIRECTOR, AITHM

The staff, students and members of the Australian Institute of Tropical Health and Medicine (AITHM) are fortunate to be able to work in medical research, which is one of the more uplifting of human endeavors. It is very satisfying to harness intellect, creativity and ethics in the service of knowledge and the alleviation of disease. Far from being dry and technical, scientific research is full of human interest. The 2018 AITHM Annual Report bears testimony to the passion, drive and commitment of our workforce, and to the depth, breadth and strength of our diverse national and international partnerships.

AITHM researchers work in laboratories, in hospitals, in suburbs, in cities, in remote field sites, in communities, in neighbouring countries throughout the Indo-Pacific region, in industry, and in partnerships, particularly in Aboriginal and Torres Strait Islander communities. We work with fellow researchers, with clinicians, with health care providers, with entrepreneurs, with philanthropists, with school students, with patients, with politicians and with public servants. AITHM is privileged to have such a diversity of friends, colleagues and relationships. We have attempted to acknowledge as many as possible in these few pages but inevitably we will fall short given the scale of the network.

The main motivation of our team is to carry out research in service of health and wellbeing, but the work we do also contributes to economic development through commercialisation of research outcomes and improvements in the efficiency of service delivery. AITHM is resolutely fixed on the translation of our research into real-world outcomes, whether they be new products such as drugs, vaccines or diagnostic tests, or new insights into health service delivery for the benefit of

patients. Needless to say, our primary focus is on the health of peoples living in the Tropics, whether they be in Australia or abroad. Given our own tropical location in Northern Queensland, and the intricacies of tropical health and medicine, we feel a strong responsibility to meet the distinctive health needs of the peoples of the Tropics, which will be home to 50 per cent of humanity and 66 per cent of the world's children within three decades.

In order to streamline our activities conceptually, we have organised AITHM's research into three overarching themes in 2018. These themes are

1. Diseases of high burden in the Tropics - dealing with all types of diseases both chronic and communicable that are found with higher prevalence or incidence in the Tropics;
2. Tropical health security - dealing with infectious disease threats to the north of Australia and to the region as a whole; and
3. Tropical health systems - focussing on strengthening health systems and health workforce, particularly in tropical, rural, remote and Indigenous communities.

Included within these abbreviated headlines is a full range of fascinating agendas, for example, mining our tropical reef and rainforest biota for new drugs. This Annual Report elucidates these activities in more detail.

In yet another example of the breadth of AITHM's endeavours, our researchers continue to lead a consortium of institutions in strengthening partnerships and workforces for our near neighbours in the Indo-Pacific, actively building research mentorship, workforce development and mutual learning, as well as producing inno-



vative tools for policy evaluation and decision-making support. Stronger international health system surveillance, early warning, and response capacity of this type provides a front line for the health security agenda at home and abroad, supporting timely, effective responses to existing and emerging infectious disease threats such as tuberculosis and Zika virus.

In another highlight, together with the Research Services sector of James Cook University, AITHM reviewed and updated relevant innovation and commercialisation policies and entered into detailed negotiations with venture capitalists, pharmaceutical industry partners and other stakeholders across a number of projects in 2018. One notable result was the foundation of a start-up company, Paragen Bio Pty. Ltd., with James Cook University a shareholder in partnership with Abbie Ventures Inc. and Brandon Capital Pty. Ltd. Paragen Bio operates out of the laboratories of Distinguished Professor Alex Loukas in the AITHM Cairns facility.

It is worth noting that since the establishment of AITHM in 2013, we have been engaged continuously in building scientific research capacity in the Northern Tropics. 2018 saw the culmination of four years of infrastructure capacity building, with the completion and opening of outstanding new research facilities in both Cairns and Thursday Island. Officially opened in March by the Minister for Resources and Northern Australia, Senator the Hon. Matthew Canavan, AITHM Cairns offers a superb new facility for our expanded workforce. Notable features of the facility are highly sophisticated analytical equipment for molecular science, and a dedicated Quarantine Containment Level 2 (QC2) facility for the safe study of mosquito vectors of disease. This builds on the already impressive mosquito biology

research infrastructure developed at JCU during earlier proof-of-principle trials.

In an event that was celebrated with great enthusiasm and support from the people and community of the Torres Strait, Queensland Minister for Training and Skills Development, The Hon. Shannon Fentiman, officially opened the new Thursday Island AITHM facility adjacent to the Thursday Island Hospital in November 2018. At the facility, AITHM researchers are working on issues of particular relevance to the Torres Strait and the rest of the nation, including infectious diseases such as tuberculosis; chronic diseases such as diabetes and obesity; and controlling the spread of mosquitoes that transmit diseases such as dengue fever.

This physical infrastructure, which adds to the AITHM Townsville facility opened in 2016 by the Hon. Annastacia Palaszczuk, Premier of Queensland, provides a necessary and state-of-the-art environment for our talented research scientists and clinicians, and the equally talented support personnel who keep things working smoothly.

In the five years since AITHM was established, membership has grown to more than 280 people who are dedicated to the improvement of health and medicine in the Tropics. Through AITHM, more than 100 new jobs have been created, many of them in highly skilled areas such as epidemiology, mathematics, immunology, bioinformatics and biomedicine. A significant scientific workforce is developing in Northern Queensland through the efforts of AITHM and JCU, creating new jobs, and nurturing future talent. We look forward to AITHM contributing to further growth in the local knowledge economy, and improving the health of Queenslanders and tropical populations worldwide.

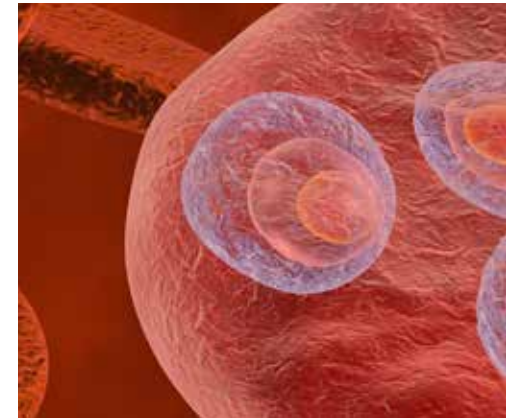
# 2018 AT A GLANCE

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\$6.4M

External research  
income



548

Refereed scientific papers  
published by AITHM and JCU's  
Division of Tropical Health and  
Medicine (DTHM) researchers



29

Graduations of DTHM Higher  
Degree by Research students

287  
AITHM Members



275

Higher Degree by Research  
students enrolled in JCU's  
DTHM and supported by AITHM





## 88 STAFF MEMBERS

49 Research staff - 39 Technical and Professional staff



## 1,130

Commentaries across print, television, radio and online platforms arising from 15 media releases



## 31

Community events and outreach visits by AITHM researchers



## 224

Tweets



## \$17M

### Annual expenditure

Much of which is invested in the local economy



## 219

### Facebook Posts





# OUR RESEARCH





**A**ITHM comprises a broad range of multidisciplinary research teams including laboratory scientists, field scientists, data analysts, clinicians and other health pro-fessionals who deliver real world scientific, social and economic solutions.

Our research is focussed on the discovery of new information, solutions, and translation to deliver improved therapeutics, drug discoveries, diagnostic tools, policy improvements and cures. We work in collaboration with clinical partners to undertake research that addresses key health issues affecting people who live in the Tropics.

We deliver research outcomes that improve the efficacy of healthcare delivery and health outcomes for the communities of Northern Australia and our neighbouring tropical nations. We are leaders in the development of diagnostics in health systems, and service delivery for rural and remote communities, including telehealth.

We invest significantly in the development and retention of academic and clinical scientific talent, including young researchers across our four regional Northern Queensland sites – Townsville, Cairns, Mackay and Thursday Island.

With a strong and established record of success in preventing infectious diseases, vector control, and health system development, AITHM is well positioned to help support Australia's vulnerable north and to build upon its extensive network of collaborators across the Indo-Pacific region.

**Our research is focussed across three broad themes:**

1. Diseases of high burden in the Tropics
2. Tropical health security
3. Tropical health systems



## RESEARCH THEME I

### Diseases of high burden in the Tropics

Work within this research theme focusses on improving prevention, diagnosis and treatment of infectious and chronic diseases of relevance to the Tropics. AIITHM researchers are working on the development of new diagnostic tools and therapeutics, and conducting studies in immunology, host-pathogen interactions and epidemiology. Our vaccine development program includes vaccine candidates for malaria and tuberculosis (TB).

Work in this area includes:

- Tropical infectious diseases such as malaria, TB, dengue and parasitic helminths infections
- Vectors through which these diseases are transmitted
- Chronic non-communicable diseases that are prevalent in tropical populations including:
  - ▶ Diabetes
  - ▶ Mental illness
  - ▶ Respiratory inflammation and allergy
  - ▶ Cardiovascular disease
  - ▶ Wounds and healing
  - ▶ Age-related diseases
  - ▶ Occupational diseases related to industry in the region including mining
- Toxinology including studies on jellyfish, cone snails, stonefish, scorpions and spiders
- Exploiting the therapeutic benefits of tropical flora and fauna including products from reef, rainforest and tropical parasites.



## RESEARCH SNAPSHOTS

### IMMUNOLOGY AND VACCINE DEVELOPMENT

**A**ITHM Director, Distinguished Professor Louis Schofield, has two malaria vaccine candidates in development. One has recently completed safety studies in humans in collaboration with QIMR-Berghofer. Professor Schofield is also developing a saccharide-conjugate vaccine that attacks a universally conserved target present in most stages and species of the malaria parasite. Manufacturing in compliance with regulatory standards, for clinical Phase I safety studies in Townsville, is now underway.

Professorial Research Fellow in Infectious Disease Immunology and AITHM Deputy Director, Professor Denise Doolan, and her team are working on the development of vaccines, immunotherapeutics and diagnostics for infectious and chronic diseases with a focus on malaria as a model. The team uses state-of-the-art, genome-based technologies. These technologies are used to analyse samples from controlled experimental infection studies in humans, individuals living in disease-endemic areas, and animal models of disease to explore host pathogen immunity, develop next generation vaccines, and discover novel biomarkers of disease risk.

Biologist Dr Stephan Karl has recently established an experimental platform to feed human blood infected with *Plasmodium* to *Anopheles farauti* mosquitoes. This development will allow him to test the capability of new vaccine and drug candidates to block transmission

of the malaria parasite.

Senior Research Fellow Dr Andreas Kupz is working to develop an effective life-long vaccine for TB. His team's focus is on early interactions between intracellular pathogenic microbes, such as mycobacterium tuberculosis, *salmonella enterica* and *toxoplasma gondii* and the host immune system, and the implications for the vaccine development. In particular, they are considering how non-classical immune responses contribute to pathogen control and how they can be incorporated into vaccines for other immunosuppressive conditions, such as human immunodeficiency virus (HIV) and type 2 diabetes.

Principal Research Fellow in Molecular Immunology, Associate Professor John Miles and his team are focussed on basic immune processes, looking for correlations between immune response and the level of disease protection or susceptibility in an individual, then attempting to correct dysfunctions by applying engineering principles to enhance or develop the immune system.



AITHM Deputy Director,  
Professor Denise Doolan.

### ASKING QUESTIONS AND FINDING ANSWERS IN TROPICAL BIOMES

Four AITHM research teams are dedicated to uncovering the health and healing potential of parasitic and venomous creatures from the Tropics. Distinguished Professor Alex Loukas and his team are working to identify products secreted by parasitic helminths that might form the basis for next-generation therapeutics for non-infectious and autoimmune diseases.

Dr Paul Giacomin and his team are extending these studies to the clinic and investigating the potential of helminths including hookworms to control chronic diseases, including coeliac disease.

The structural biology research team, led by Professor Norelle Daly, is focussed on discovering structure-function relationships of peptides derived from parasite proteins and venoms (spiders, cone snails and scorpions). The team's aim is to develop therapeutic drug leads for a range of conditions including inflammatory diseases and diabetes by using tightly folded scaffolds to improve the stability of peptides, thereby allowing their development into useable therapeutics.

Toxinology researcher Associate Professor Jamie Seymour works at the intersection of medical and biological research. His team has a particular interest in venomous marine creatures such as Irukandji, cone snails and stonefish. The team conducts research on venomous animals to manage their effects on humans and discover potential uses of venom products for novel therapeutics.

## CHRONIC AND NON-COMMUNICABLE DISEASES

Distinguished Professor Jonathan Golledge and his team at the Queensland Research Centre for Peripheral Vascular Disease are dedicated to improving management of peripheral vascular disease (PVD). The team is currently engaged in six clinical trials focussed on presenting signs and symptoms of PVD. The team also conducts research in the areas of stroke and wound healing.

Professor Andreas Lopata leads the Molecular Allergy Research Laboratory, which uses cutting-edge approaches to characterise the interactions of immunogenic proteins from different food sources that lead to allergic and inflammatory reactions. The team is building a biobank of allergenic samples, as well as engaging in clinical trials to develop faster, and more easily administered diagnostics and therapeutics that can be used in locations that do not have specialist allergy staff.

The laboratory of Psychiatric Neuroscience, headed by Professor Zoltan Sarnyai, focusses on the neurobiological mechanisms of stress and psychiatric disorders, including drug addiction, schizophrenia and depression. The team's current research includes laboratory-based projects investigating the links between diet, gut bacteria and schizophrenia.

## BIG DATA AND BIOINFORMATICS

Senior Research Fellow Dr Matt Field, Research Fellow Dr Ashley Waardenberg and colleagues are integrating big data with immunology, molecular biology and medicinal chemistry applications to better understand mechanisms of disease, and discover and develop new therapeutics or diagnostics. Dr Field and his team also support a wide variety of projects within AITHM, including the analysis of large next-generation sequencing data sets. Specific projects include: development of software to uncover the underlying genetic cause of human diseases such as lupus, diabetes, and melanoma, and investigating how to utilise sequence information to identify causative pathogens in infectious diseases in Northern Australia.

## OCCUPATIONAL HEALTH AND SAFETY

Principal Research Fellow, Associate Professor Gunther Paul and his team focus on complex work related issues such as health systems, mine and workplace related respiratory health, human-in-the-loop modelling and musculoskeletal disorders. The team is based in Mackay and their current projects include the development of products and solutions for pressure sores and choosing sun-safe clothing.

### ALLERGY ANSWERS FOR AUSTRALIAN PEOPLE AND AUSTRALIAN SEAFOOD

**A**ITHM Research Fellow Dr Sandip Kamath has a three-part plan to improve diagnosis and treatment of potentially deadly seafood allergy. Part one of his plan involves building a biobank of local seafood samples. Part two includes the analysis of human and allergen samples to gauge the severity and frequency of allergic reactions in hundreds of people. Finally, he plans to develop a simple pinprick allergy-testing device, and a vaccine.

Dr Kamath works with Professor Andreas Lopata in the Molecular Allergy Research Laboratory, and has worked his way through several steps of his plan. 2018 was a busy year. He and his team collected more than 200 local fish and shellfish samples and gathered more than 400 human blood samples. Seventy of these blood samples were obtained from North Queenslanders in the Townsville Translational Research Facility. Dr Kamath is also collecting samples in collaboration with the Alfred Hospital in Melbourne and the Westmead Children's Hospital in Sydney.

Most of Australia's seafood allergy testing is based on European seafood samples. However, an allergy test for the Alaska Pollock, the fourth most commonly consumed fish in Europe, is not effective in protecting the population against allergy to Barramundi and Black Tiger Prawn. Dr Kamath and his colleagues have been visiting local seafood markets to collect local samples, which they blend with a solution to enable molecular

level analysis.

"We now have big inventory of allergenic proteins from our local region that we can use for molecular analysis. We store them at very low temperatures in the AITHM cryostore (biobank) facilities. Now I am testing to find answers to questions like: which species do people in this part of the world react to most seriously and most often," explained Dr Kamath.

Dr Kamath looks for an antibody called IgE in blood samples when he is testing for allergic reactions. This particular antibody is present in the blood of allergic people; it binds like a magnet to the allergenic proteins that travel to the bloodstream after consumption of seafood. It is this reaction that can cause blood pressure to drop and, in extreme cases of anaphylaxis, an allergic reaction that can fatally shut down the body.

Not all seafood-allergic people react, however, to all types of seafood. Dr Kamath has now identified one of the most allergenic species of Northern Australia: the Black Tiger Prawn. There are six to seven allergens in the Black Tiger Prawn that trigger a reaction in 90 per cent of people with sea-

food allergy. As a result, Dr Kamath will use Black Tiger Prawn allergens as the basis for development of new diagnostics and treatments.

Dr Kamath's research is important because one in 100 people have a seafood allergy. It is not an allergy that people grow out of, and present diagnostics are not as relevant and accessible as they could be for people in Northern Australia. Peanut allergy may be in the news more often, but fish and shellfish allergies account for more deaths in Australia than any other type of allergy.

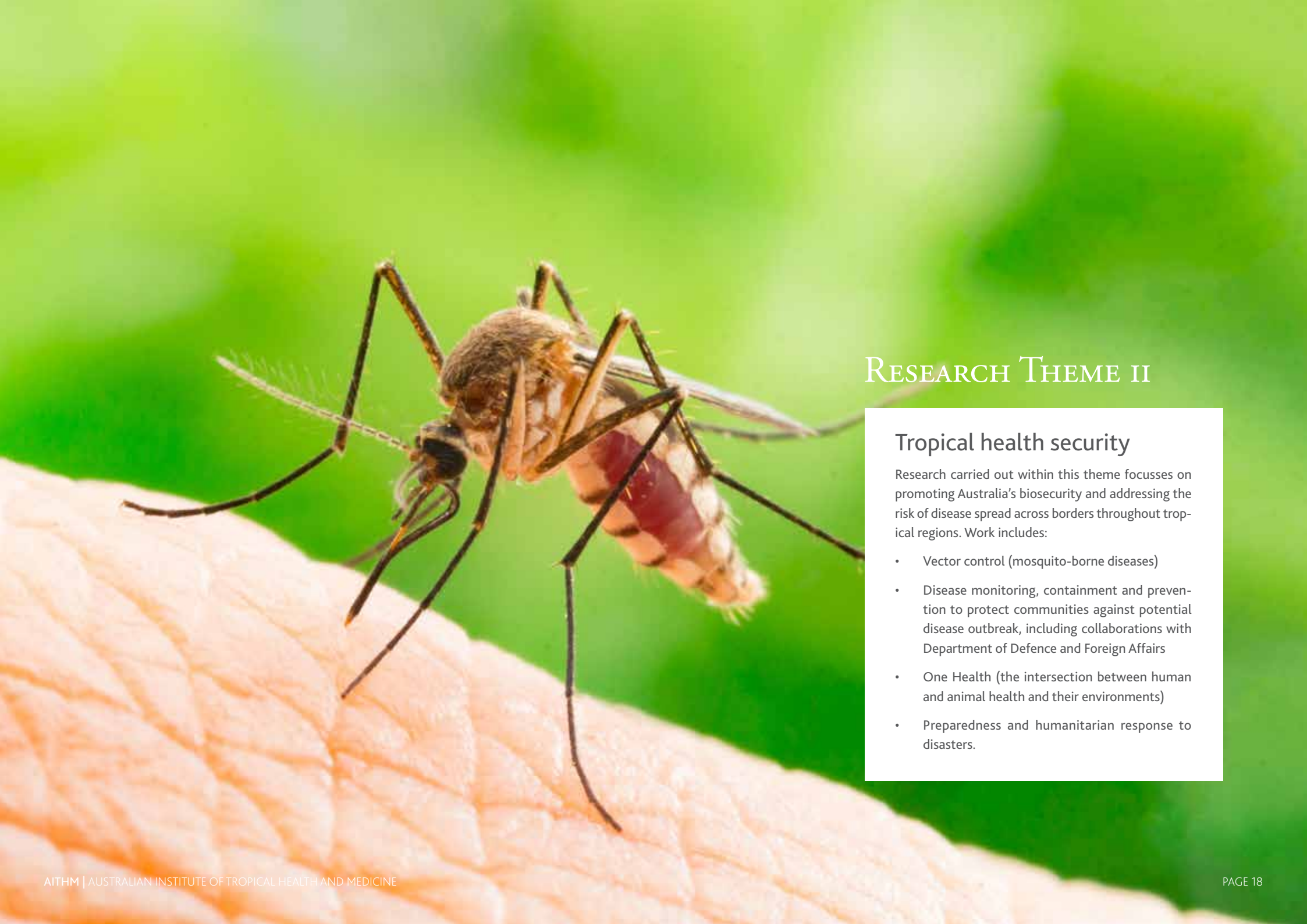
"My aim now is to use the knowledge I have gained about how to deal with allergens to develop a vaccine to treat fish and shellfish allergy, and also to develop a hand-held diagnostic device that can determine if a patient is sensitised and what they are sensitised to," said Dr Kamath, "A general practitioner could use a device such as this."



#### **Cryostore (Biobank)**

*The cryostore facilities at both Townsville and Cairns AITHM are capable of storing and cataloguing an extensive biological sample library for biomedical research into human diseases. Both sites have capacity for storing up to 80,000 biological samples under liquid nitrogen (-190°C), in addition to ultra-low storage in -80°C freezers.*





## RESEARCH THEME II

### Tropical health security

Research carried out within this theme focusses on promoting Australia's biosecurity and addressing the risk of disease spread across borders throughout tropical regions. Work includes:

- Vector control (mosquito-borne diseases)
- Disease monitoring, containment and prevention to protect communities against potential disease outbreak, including collaborations with Department of Defence and Foreign Affairs
- One Health (the intersection between human and animal health and their environments)
- Preparedness and humanitarian response to disasters.

### DISEASE MONITORING AND CONTAINMENT

Professor Emma McBryde and her team are using mathematical modelling to better understand the epidemiology of TB: how the bacterium invades the body, and how it spreads through populations. Research is focussed in three main areas:

- Understanding TB to lead to better identification, screening, mapping, modelling and investigation of the immune response to TB pathogens and zoonosis
- Diagnosing TB, which includes research into current diagnostic processes, testing and screening methods
- Preventing TB through capacity building and collaboration.

Importantly, the research team works with partners throughout the western Pacific regions to protect Australia's borders, preserve national health security, and enhance access to new and effective tools for Northern Australia and the Indo-Pacific. Associate Professor Jeffrey Warner and Associate Professor Catherine Rush are leading capacity building and field work studies on TB in the Balimo region of Papua New Guinea.

### NATIONAL AND INTERNATIONAL NETWORKS

An important component of research under this theme is collaboration between our JCU research team and global partners in the region. Dean of the College of Public Health, Molecular and Veterinary Sciences, Professor Maxine Whittaker, has a special interest in the issue of scaling-up pilot programs into policy and practice. She is a founding member of Expandnet, and is the co-chair of the World Health Organisation (WHO) Research Project Review Panel (RP2) of the Department of Reproductive Health and Research. In 2018, she was invited to be a member of the 10-member Technical Reference Group of the Indo-Pacific Centre for Health Security (Department of Foreign Affairs and Trade, Australia), and is the Chair of the Board of Trustees and member of the Scientific Advisory Group of the International Center for Diarrhoeal Disease Research, Bangladesh (icddr,b).

### PREPAREDNESS AND HEALTH AND HUMANITARIAN RESPONSE TO DISASTERS

Associate Professor Caryn West and her team draw on the theme of resilience in their research and training programs to support tropical communities to prepare and respond to disaster. Her team's disaster management work is carried out in collaboration with international agencies such as the World Health Organisation Collaborating Centre (WHOCC) for Nursing, Midwifery Education and Research Capacity Building, and the Asia Pacific Emergency Disaster Nursing Network (APEDNN).

### VECTOR CONTROL

Northern Australia and neighbouring countries in the Indo-Pacific are susceptible to outbreaks of debilitating and fatal viral diseases carried by mosquitoes. Two of AITHM's research teams work to understand, contain and prevent outbreaks and spread of vector-borne diseases.

Professor Tom Burkot and the vector ecology and biology team focus on improving the control of vector-borne diseases, concentrating on malaria and dengue fever. They target three areas:

- Improving vector surveillance through capacity building in developing countries
- Providing a biological understanding of vectors to identify vulnerabilities and select novel interventions
- Defining the interactions of humans and mosquitoes (where and when transmission to humans occurs – residual transmission).

Professor Scott Ritchie and the public health entomology research team are focussed on developing methods to prevent human outbreaks of mosquito-borne diseases caused by viruses, especially:

- The *Aedes* mosquitoes (*Aedes aegypti*, *Aedes albopictus*) which carry dengue, Zika and chikungunya viruses that, within Australia, threaten Northern Queensland exclusively
- Mosquitoes that carry viruses causing Ross River fever and Murray Valley encephalitis.

# HELPING TORRES STRAIT COMMUNITIES BATTLE TUBERCULOSIS, A PhD STORY

For PhD student, J'Belle Foster, the statistics she is exploring about the spread of tuberculosis in the Torres Strait islands are more than just numbers. They represent the individual lives of patients she has met through her own frontline healthcare initiatives.

"As I trawl through my data, I often come across individuals that I have come to know, that have been treated within our program for this disease," said Ms Foster, the Nursing Director of Queensland Health's Torres and Cape TB Control Unit – the first of its kind in the region – which she established in 2016.

Her joint AITHM JCU PhD study, supported by supervisor AITHM

Professor and Queensland Health TB Physician, Emma McBryde, aims to characterise the epidemiology and management of TB in the Torres Strait islands from 1950-2020, including the emergence of multi-drug resistant TB, particularly in Papua New Guinea (PNG).

"There has been much media hype on cross-border transmission, but little academic research done on the subject," Ms Foster observed. "The best way I can effect change and improve outcomes in this community is by shining a light on the TB situation that is evidence-based."

"I am in the very fortunate position that my PhD is directly aligned with my nursing role," she said. "I frequently identify issues in the TB Control Program and make a note to follow it up within my PhD and vice versa."

There is evidence that primary transmission of TB is occurring in the cross-border region, with around 27,000

PNG nationals making annual visits to the Torres Strait Protected Zone, where local Indigenous residents from both Australia and PNG can move freely without passports or visas for traditional activities.

TB in PNG, including on Daru Island where the general hospital handles

the referral of all PNG national TB patients diagnosed in the Torres Strait, has been declared a public health emergency, with rapidly rising rates of multi-drug resistant TB.

"We know that there are various risk factors that perpetuate high rates of TB, and most are found within the cross-border region," Ms Foster said. "These include poor nutrition, overcrowding, treatment delay and interruptions, co-morbidities, personal financial constraints, disrupted health services and limited human resources."

Within the first two years of operation, the Torres and Cape TB Control Unit handled 959 patient consultations, not including TB vaccinations.

Community support plays a crucial role in both Ms Foster's research and work roles, with many residents highly anxious about the risk of TB infection and/or reeling from the impact the disease has already inflicted on their families and villages. In fact, community consultation helped to form her PhD research proposal.

"Although I live and work in the Torres Strait, I have a different connection to the place than locals, and what I may see as a priority may not be the same as for community members," she said.

"So, consultation with community members has helped me to shape my research proposal to best provide answers important to them. I firmly believe that there is no point in doing research if it isn't going to benefit anyone. I don't want a PhD that just collects dust on a shelf. Any results of my research need to be shared with the community and that is what I intend to do."

"I am in the very fortunate position that my PhD is directly aligned with my nursing role."





***"The best way I can effect change and improve outcomes in this community is by shining a light on the TB situation that is evidence-based." Ms J'Belle Foster.***





## RESEARCH THEME III

### Tropical health systems

Research within this theme focusses on strengthening health systems and health workforce, particularly in tropical, rural, remote and Indigenous communities. Work includes:

- Improving models of healthcare delivery
- Health workforce development
- Translating research findings into healthcare improvements
- Capacity building within underserved healthcare systems.

### IMPROVING MODELS OF HEALTHCARE DELIVERY

The chronic disease prevention team, led by Professor Robyn McDermott, works with service providers, community organisations and academic partners to improve prevention and primary care management of chronic conditions common in Northern Queensland, including obesity, diabetes, cardiovascular and renal disease, especially in high risk populations (including Indigenous populations). The team works with large population datasets to better understand causal pathways, including nutritional determinants of risk, the reasons for excessive hospital admissions for preventable chronic conditions, the promotion of evidence-based primary care in chronic care, and identifying key points for intervention to improve health outcomes in susceptible people.

Medical tele-oncology expert, Professor Sabe Sabesen, and his team have developed and evaluated various tele-oncology models of care to deliver rural cancer care closer to home, including the Queensland Remote Chemotherapy Supervision (QReCS) model that has now been adopted statewide by Queensland Health. His research collaborations include the Townsville Hospital and Health Services (THHS), various Australian clinical trial groups, and clinicians and academics within Queensland Health and JCU in the areas of telehealth, rural and Indigenous health.

### TRANSLATING RESEARCH INTO HEALTHCARE IMPROVEMENTS

Professorial Research Fellow Alan Clough and the community-based health promotion and prevention studies group are compiling fundamental data around complex mental health related emergency department (ED) presentations in Northern Australia. Young people, Indigenous Australians and people living in rural, remote and impoverished areas have higher rates of complex ED mental health admissions where substance misuse, suicide or self-harm might also be a factor.

The team aims to use the data to evaluate interventions and strengthen pre-hospital interventions and post-discharge care strategies. Professor Clough's team is partnering with Directors and Staff Specialists in five North Queensland hospitals, the North Queensland Primary Health Network, Queensland Police Service, Queensland Ambulance Service, Neami National community mental health service and Queensland's Emergency Medicine Foundation. The collaboration also includes specialists in research translation for both non-Indigenous and Aboriginal and Torres Strait Islander groups from the University of Sydney and QIMR Berghofer and legal researchers from the Australian Centre for Health Law Research at Queensland University of Technology.

### HEALTH WORKFORCE DEVELOPMENT

The research team of Professor Sarah Larkins has a goal to collaborate for the improvement of equity in health care for underserved populations, particularly rural, remote, Indigenous and tropical populations. The team uses a strengths-based approach to research, working with Aboriginal and Torres Strait Islander communities and the health workforce to equip people with the appropriate knowledge, attitudes and skills needed to achieve greater equity in health care delivery.

### CAPACITY BUILDING WITHIN UNDERSERVED HEALTHCARE SYSTEMS

The capacity strengthening team, led by Professor Sarah Larkins, Professor Maxine Whittaker and Associate Professor David MacLaren, as part of the Tropical Partners project has, since 2017, delivered an extended year-long research training program to more than 50 health professionals from five countries (Fiji, Indonesia, Papua New Guinea, Solomon Islands and Timor-Leste). The team uses the WHO's Structured Operational Research and Training Initiative (SORT-IT) model, which has been customised to support advocacy, policy and practice translation in the Indo-Pacific.

# HIGH-TECH GENETIC SEQUENCING TOOLS PUT TO THE DIAGNOSTIC TEST

Getting the diagnosis right for patients coming to hospital can be a complicated exercise. Making the right diagnosis depends on the right people ordering the right tests at the right time. In remote settings where hospitals might have limited resources, diagnostics are particularly difficult.

A team of AIITHM and JCU researchers and hospital clinicians is exploring the potential of modern genetic sequencing tools to take much of the risk, uncertainty and time out of the diagnosis process, a project that has sparked interest from other hospitals, professional organisations and researchers.

Professor John McBride from JCU's College of Medicine and Dentistry, and the Clinical School at Cairns Hospital led the initial clinical genetic sequencing trials. AIITHM's Dr Paul Horwood and Dr Matt Field are leading the analysis of results.

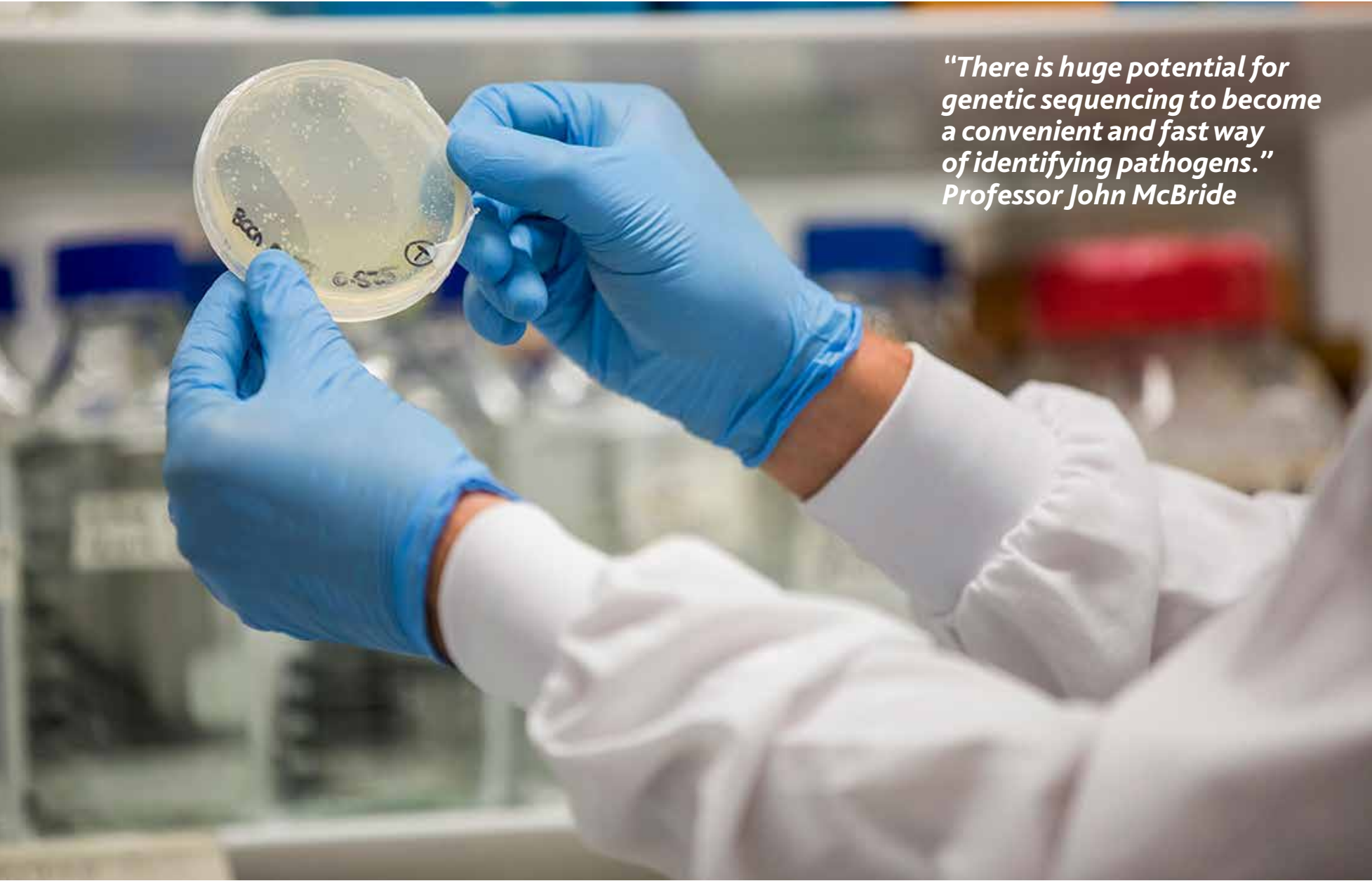
"With traditional diagnosis, a range of tests and techniques are applied in the laboratory to confirm the clinician's suspicions," said Professor McBride. "There is huge potential for (genetic sequencing) to become a convenient and fast way of identifying pathogens (disease-causing agents that include bacteria, viruses, fungus). The question is: can we achieve the same answers." Samples have been collected from 30 patients presenting with infection at Darwin Hospital and Cairns Hospital. Researchers then compare the conventionally obtained test results with those generated by two different genomics systems methods. One

system is the portable MinION genomics device, which is about the size of a small TV remote control and can give real-time sequencing results in less than an hour. The other system provides in-depth sequencing but can take several days to give results.

Professor McBride said the team is hoping to find the best method of genomics testing for rollout in regional Queensland hospitals. Sequencing technology might also present a diagnostic solution in remote areas where Aboriginal Australians experience a significantly higher death rate from sepsis than other populations.

One of the major challenges for clinicians will be learning how to read and interpret the samples and use the information most effectively. This project, enabled through HOT NORTH, based at the Menzies School of Health Research, is funded by the National Health and Medical Research Council. A new project, which will build on the one described, has been funded by the Queensland Genomics Health Alliance (QGHA) and will enable a new trial to be conducted at the Townsville Hospital and Health Service in 2019.





*"There is huge potential for genetic sequencing to become a convenient and fast way of identifying pathogens."*  
Professor John McBride

# OUR STORIES







**A**ITHM researchers work in the field, in communities, in hospitals, in industry and development and in partnership with Aboriginal and Torres Strait Islander researchers. Here, we share a selection of stories of our researchers' discoveries and achievements throughout these diverse settings in 2018.

# unlocking the TROPICAL BIOME

## THE STING IN THE TALE

PhD student Edward Evans is exploring the factors that influence the release and quantity of specific toxins in scorpion venom to optimise venom harvesting for pharmaceutical research and anti-venom production.

"I aim to identify variations in venom compositions on several levels; between scorpion species, between individuals of the same species, and also within the same individuals throughout their life stages," Mr Evans said.

Previous AITHM research has found that scorpions are able to change their venom composition in response to their predators. They are the only venomous animals currently known to do so.

Advances in analytic technology are now assisting researchers to pinpoint when and why individual scorpions calibrate changes to their venom, which will aid in developing laboratory conditions that can maximise the yield of venom specimens for research purposes.

"If we can actually change scorpion venom compositions in the

lab, by inducing reactions to predators and prey, we can encourage them to produce more specific toxins of interest," Mr Evans explained.

"I aim to identify variations in venom compositions on several levels; between scorpion species, between individuals of the same species, and also within the same individuals throughout their life stages."



Mr Evans is currently investigating four native scorpion species, which he sources from collectors in the region and interstate, but he also collects samples that are commonly found around Cairns and nearby Kuranda, equipping himself with a pair of tweezers and disposable food containers.

Australian scorpions are typically not deadly to humans, unlike their cousins in countries such as Mexico, which claim hundreds of lives per year. However, Mr Evans has already uncovered significant variations in toxin levels between individuals of the same species, which may explain why some people suffer more than others when stung.

"I am keen to discover whether these are just random variations or if there is some underlying process governing it," he said.

## INVERTEBRATES TAKE CENTRE STAGE

Tucked away in the Kuranda rainforest, near Cairns, professional science photographer Alan Henderson and his zoologist wife, Deanna, preside over the largest range of captive bred and sustainably collected invertebrates in Australia... an insect and arachnid 'empire' that they kindly share with AITHM researchers.

Despite Australia's reputation for its venomous animals, and AITHM's access to a nation-wide network of invertebrate collectors and other keen contributors, sourcing new live specimens is an ongoing challenge.

The Hendersons, whose business is called Minibeast Wildlife, have been happy to volunteer their time and resources to AITHM animal venom researchers. Every six weeks or so, AITHM scientists visit the Kuranda property to milk resident Sydney funnel web spiders and two local species of scorpion, then take away the samples for laboratory analysis.

The quantity of venom required for analysis depends on the type of information the researchers are seeking. "Fingerprinting" – the separation of venom components to obtain mass information on a particular species – requires as little as one micro-litre. The isolation and investigation of individual venom components demand bigger samples.

A passionate wildlife educator, Alan Henderson hopes the AITHM research projects will help counter the widespread public attitude that spiders and other invertebrates are pests that should be eradicated.

"Without invertebrates, world ecosystems would collapse, but not everyone sees it that way," he said, "but if you can tell them that a spider's venom may one day save their life, that's a different story."

Collaborating with AITHM is enabling him to expand his own knowledge of invertebrates – and even point the scientists in new research directions.



## EXPLORING THE MEDICAL POTENTIAL OF INSECT FUNGI

**B**izarre-looking parasitic fungi that grows on insects in Far North Queensland rainforests could yield a new treatment for infectious diseases and cancer, according to AITHM natural products chemist, Dr Phurpa Wangchuk.

He has already identified one species of insect fungus that produces a highly active molecule that can regulate immune response. These type of compounds, known as immune modulators, form the backbone of immunotherapy by stimulating the patient's own immune system to battle disease.

In collaboration with AITHM immunologist, Professor Denise Doolan, compounds extracted from insect fungi are being screened in the laboratory to see whether they can stimulate or inhibit specific parts of the human immune response, before being tested in mouse models for their ability to shrink tumours.

Born and raised in Bhutan, Dr Wangchuk researched a cornucopia of traditional medicinal plants and fungi while working for the Bhutanese Ministry of Health's Pharmaceutical and Research Unit. Upon joining AITHM in 2014, Dr Wangchuk was keen to investigate tropical

insect fungi of Far North Queensland, collected by then JCU Adjunct Senior Research Fellow, Dr Sandra Abell, who worked with the Australian Tropical Herbarium at JCU.

"We have huge natural resources – plants, fungi – that compare with the Amazon in Brazil."

the laboratory.

"In the wild, fungi, like plants and insects, produce molecules to defend themselves against predators and competitors. When you grow them in the laboratory (using an agar nutrient solution), often you lose that activity, so it is challenging to obtain these bioactive molecules within lab conditions," he observed.



*Natural products chemist,  
Dr Phurpa Wangchuk.*

The stakes are high. Apart from producing potential drug candidates to treat infectious diseases or cancer, Dr Wangchuk's research has revealed that insect fungi may also harbour promising

adjuvants – substances used to activate the immune system to enhance the effectiveness of vaccines against a range of diseases.

He hopes his findings will attract funding to accelerate his own research as well as other projects to identify and harvest the health benefits of Far North Queensland's rich biodiversity.

"We have huge natural resources – plants, fungi – that compare with the Amazon in Brazil," he said. "We need to explore those natural resources for the benefit of mankind."

## UNLOCKING THE POWER OF VENOM

Structural biologist, Professor Norelle Daly and biochemist, Dr David Wilson have been bitten by the same bug – the desire to expand knowledge of Australian venomous animals, including their potential to yield new life-saving drugs.

Based in Cairns, they are on the frontline of venom research; collecting animals, then harvesting and analysing the potent toxins they produce. With the help of citizen scientists, research students and commercial collectors, they have filled their laboratory with an array of venomous native species, including spiders, cone snails and scorpions, which are milked to supply samples for state-of-the-art analysis.

“We hope to contribute to knowledge on the composition of venoms, including their bioactivities, to provide insight into designing novel drug leads,” Professor Daly said. “We are particularly interested in characterising novel bioactive peptides (protein fragments with potential biological activity).”

Venom peptides have been heralded as a promising source of drug candidates to treat a range of conditions, including cancer. Chlorotoxin, a peptide found in scorpion venom, has been trialled as a cancer imaging agent, based on its selective binding to tumour cells.

Venom research can also assist anti-venom production, and the development of more effective treatments for people who have been bitten or stung. Athena Andreosso, a PhD student in Professor Daly’s structural

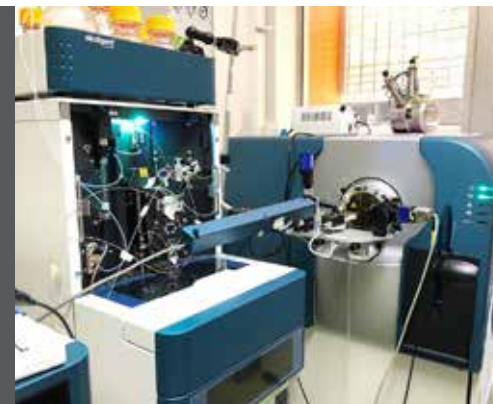
biology research group, is investigating the key components of lethal Australian box jellyfish venom in order to improve emergency care for victims.

The recent purchase of a \$600,000 mass spectrometer is enabling the AITHM team to obtain more information with less material. They can now sequence peptides within toxins and explore their activity. Peptide sequencing data produced by the mass spectrometer is enabling researchers to quickly zero-in on compounds which demonstrate similar activities. Combined with NMR (nuclear magnetic resonance) spectroscopy, it is assisting Professor Daly to develop three-dimensional structures of peptides – which can then be manipulated.

“Sometimes peptides may not be as stable as we want them to be (they may degrade quickly) so we make changes to improve stability, then look at what effect that has on the structure,” she said. The results of their research, once published, are uploaded onto international species-specific databases, as well as others that record the latest information on proteins, peptide sequences and their structures.

### Triple Time-of-Flight (TOF) 6600 Mass Spectrometer (MS)

*The SCIEX TripleTOF 6600 Quadrupole time-of-flight (TOF) mass spectrometer allows researchers to collect high-resolution MS and MS/MS data on complex samples, using ultra-fast acquisition rates coupled with high performance sensitivity capabilities.*

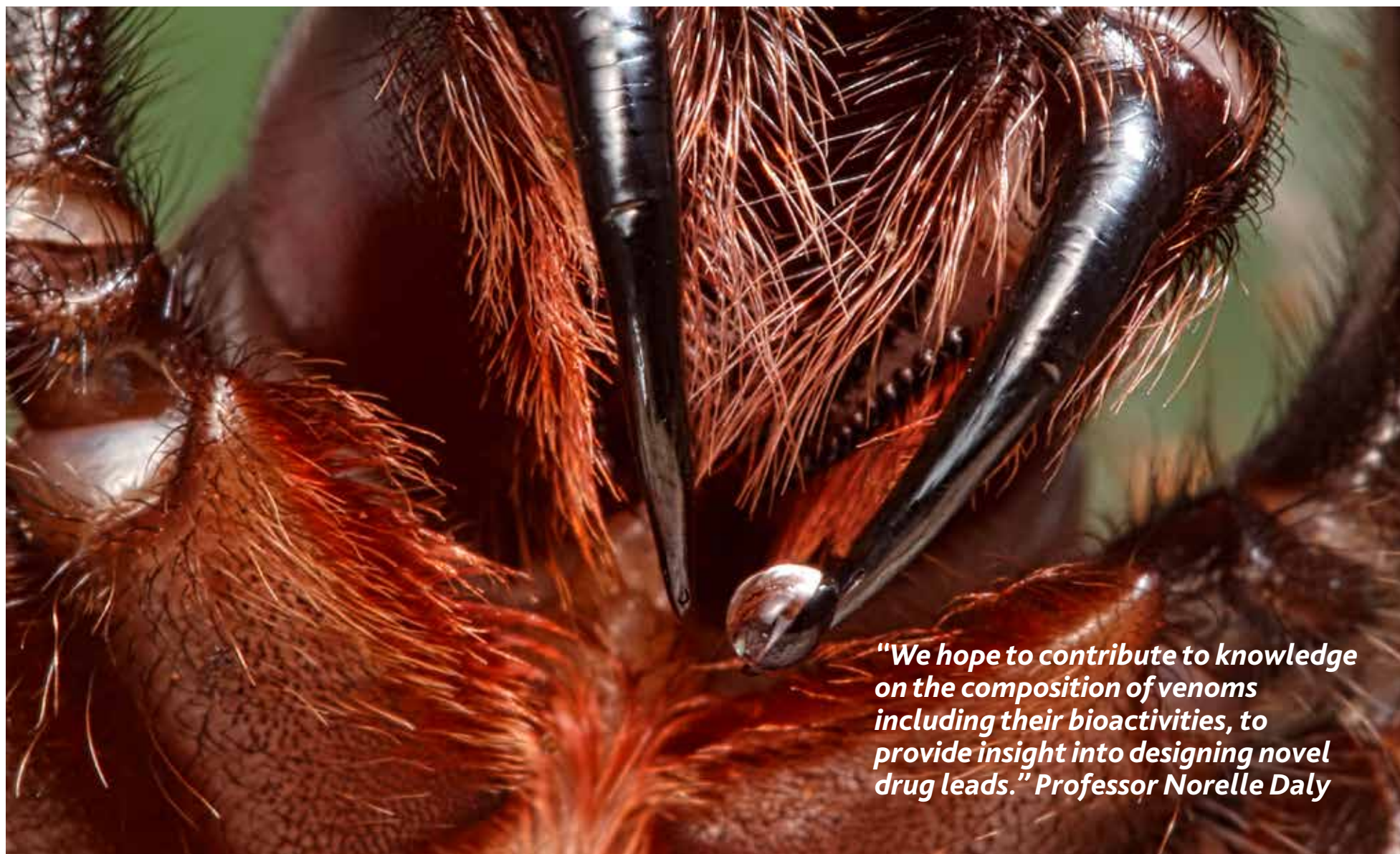


### Nuclear Magnetic Resonance (NMR)

*The Bruker AVANCE III 600 NMR Spectrometer is capable of investigating structure and dynamics in proteins, Ribonucleic Acid (RNA) and small molecules including peptides, greatly assisting in research towards uncovering drug and vaccine candidates for a variety of tropical diseases.*







***"We hope to contribute to knowledge on the composition of venoms including their bioactivities, to provide insight into designing novel drug leads." Professor Norelle Daly***

Image credit Alan Henderson



## UNDERSTANDING IRUKANDJI JELLYFISH LIFE CYCLE AND ECOLOGY: THE KEY TO AVOIDING STINGS



Many people living in Australia's north know how to avoid injury from dangerous animals in the water: stay out of estuaries and waterways, and watch your step around rock pools, for example. We know which areas are frequented by crocodiles and sharks and as a result, we know how to avoid them.

Until recently, the same could not be said of the Irukandji jellyfish, *Carukia barnesi* a creature whose sting has put more than 50 people in hospital with Irukandji syndrome during the 2018-2019 stinger season in Queensland.

AIITHM's Dr Robert Courtney, working in the team of Associate Professor Jamie Seymour, is one of very few people in the world who have witnessed first-hand the complete and complicated lifecycle of the Irukandji jellyfish: *Carukia barnesi*, which was named after a local well known doctor in Cairns. Dr Courtney has been observing and analysing the behavior and life cycle of hundreds of Irukandji jellyfish in a tank that houses one of only two populations of the creatures.

The tank mimics ocean conditions and has allowed Dr Courtney to uncover surprising information about the creature, and to debunk popular theories about their distribution as part of his recently completed PhD study.

"I firmly believe that if you understand the ecology and behaviour of an animal that is dangerous, you can make better decisions about how to avoid the animal," Dr Courtney said. "If you've never seen the whole life cycle of the animal, you can never really know how to manage its effects."

The team produced the original polyp culture of *Carukia*

*barnesi* in captivity, and has subsequently distributed it to collaborators such as Professor Kylie Pitt at Griffith University. After more than a decade of research by the team, they have uncovered and described the life cycle of *Carukia barnesi*, having found the appropriate water conditions, substrates, salinity, water flows and other factors needed to move from one stage to another of the life cycle. Dr Courtney is now using the information to better understand the Irukandji stinger season.

He said two of his key discoveries relate to the likely distribution of the polyps (or juvenile stage) and the fishing abilities of the mature jellyfish.

Dr Courtney said he had found that Irukandji polyps, which live on hard substrate such as rocks, thrive in water that is far less salty and much cooler than the open ocean. This suggests that the breeding ground for these animals is not places like coral reefs as previously thought, but possibly around 'wonky holes', which are believed to be the outlets of springs that carry fresh water via submarine channels to the seabed. Dr Courtney said another interesting discovery he made while observing Irukandji in the tanks is the deliberateness of their fishing techniques.

"We had thought these animals were swimming around haphazardly collecting prey but the opposite was hap-

pening. These animals were extending and twitching their tentacles in the water and attracting very specific sizes and species of little fish. We have a jellyfish that is essentially jigging for fish with its tentacles, mimicking something else, and small fish are seeing this as a food source and getting a face-full of venom," said Dr Courtney.

All of the results that Dr Courtney has found are being used in the development of a computer model that would allow the prediction of the timing and length of the Irukandji season but also the numbers of animals present in the water, all aimed at making the ocean a safer place for people to enjoy.

"I firmly believe that if you understand the ecology and behaviour of an animal that is dangerous, you can make better decisions about how to avoid the animal."

## BATS AND RATS AND STATS



Senior Research Fellow and virologist, Dr Paul Horwood, colloquially describes one of his longest-running research projects in Papua New Guinea as his 'bat and rat' work. Dr Horwood and his team are involved in an extensive biodiversity survey in PNG. They are collecting different species of rodents and bats – often from remote locations accessible only by helicopter – to screen for a range of pathogens, such as *Leptospira* and coronaviruses, and assess for risk of disease emergence. As humans encroach on the natu-

ral habitats of animals, they are exposed more often to so-called 'wildlife diseases'.

"Over the last decade or so, we've seen a lot of – let's say – interesting viruses emerge from bats: SARS coronavirus, Ebola... So there's a lot of interest at the moment about the emergence of novel diseases from bats," said Dr Horwood.

The biodiversity survey, which is being carried out in collaboration with the Papua New Guinea Institute

of Medical Research (PNG IMR) and the Wildlife Conservation Society, aims to help developing countries stay one step ahead of emerging diseases – diseases that could one day find their way to Australia. Using the samples and data they collect, the team sequences the viruses to learn about how they are related to other pathogens in the region, and considers the risks of emergence.

"To steal a much-used quotation: viruses do not respect borders," said Dr Horwood. "We need to know more about what's circulating, so as a global community we can have more knowledge, be better warned, and try to reduce the impact."

"We need to know more about what's circulating so, as a global community we can have more knowledge, be better warned, and try to reduce the impact."

His current survey project in PNG is also a part of a major AITHM Indo-Pacific tropical disease research initiative, the Tropical Partners Project, funded by a \$1.8 million grant from the Department of Foreign Affairs and Trade. The project extends to the Solomon Islands where Dr Horwood, together with AITHM colleagues in the field of vector ecology and biology, is exploring the circulation of (mosquito-borne) arboviruses, including dengue, Zika, chikungunya and Ross River fever.

## SURVEYING THE SOLOMON ISLANDS FOR IMPROVED VECTOR CONTROL

When AIITHM researchers travelled by boat, truck and foot to carry out vector control surveys in small villages in the Solomon Islands, community members lined up for hours to give blood samples. The aim of the cross-sectional survey was to better understand the prevalence and spread of mosquito borne diseases such as malaria, dengue and Zika virus. It was funded the Department of Foreign Affairs and Trade (DFAT), the Global Good Fund of Intellectual Ventures Laboratory (USA), and the Solomon Islands Ministry of Health and Medical Services.

Research Fellow Dr Tanya Russell explains how the vector ecology and biology research team collected samples and data from more than 2000 people in 19 Solomon Islands villages across three provinces and the nation's capital in May 2018. "We had really great participants who were very excited about contributing to a study into malaria control," said Dr Russell. "The Ministry of Health in the Solomon Islands has had resounding success in reducing malaria transmission in the past decade through long-lasting insecticidal nets, insecticide residual spraying and improved diagnostics and treatment. But the downward decline of the disease stopped in the last few years, and malaria is increasing again." The Solomon Islands has also experienced dengue outbreaks in the past five years.

Research team lead, Professor Tom Burkot, said the essential baseline information they had collected was

vital for planning and resource management in vector control. The logistics involved in this particular project were significant. The team transported large amounts of medical and scientific equipment, sometimes by foot, to remote locations. Keeping the samples cool was also a challenge solved by partners from local health services. The survey was conducted across three provinces: Guadalcanal, Auki and Isabel, as well as Honiara, the national capital. The program was made possible through the partnerships with the National Vector Borne Disease Program, Solomon Islands Ministry of Health and Medical Services, provincial health directors, nurses, national and local level staff. Study sites, each with their unique environmental conditions, were selected in consultation with the Ministry of Health and Medical Services and National Vector Borne Disease Program.

A rapid diagnostic test for malaria was also trialled during the survey by Global Good Fund of Intellectual Ventures Laboratory (USA). Samples collected in the Solomon Islands were shipped for analysis to global molecular labs at AIITHM Cairns, the University of California – San Francisco and the London School of Hygiene and Tropical Medicine.



*Dr Tanya Russell in the Solomon Islands*



## GOOD PEOPLE ARE AS IMPORTANT AS GOOD INTERVENTIONS

An entomological survey into what is working and what is not working to control mosquito-borne disease in 35 tropical nations is yielding surprising early insights. Research lead, Professor Tom Burkot, said efforts to stop or slow the spread of diseases like malaria and dengue fever were influenced heavily by the capacity of professional and technical staff working on vector control interventions.

"There is a lot of push on technologies as the answer to problems, but we are finding that capacity and training of people are the biggest issues in the Tropics," said Professor Burkot. "In countries like Sri Lanka, where they recently eliminated malaria, they succeeded despite multiple obstacles including insecticide resistance in multiple mosquito vectors and a civil war. They had well motivated, trained staff... with good people, you can overcome many things."

Professor Burkot has collected surveillance data for 35 countries throughout Africa, the Asia-Pacific and the Americas in an 18-month project funded by the Bill and Melinda Gates Foundation. "This is giving us a global picture to monitor vector control intervention coverage and quality, and to identify gaps and opportunities," said Professor Burkot. He said data was strongest around larval surveillance and the vector's physical

characteristics that make it resistant to insecticide treatment. It was weakest around vector (mosquito) identification and resistance mechanisms. The most common self-reported limitation was human workforce capacity.

Professor Burkot said he and his team had engaged in their own work to build skills and capacity for people working on the ground in 2018. Professor Burkot and his team conducted an Asia Pacific Malaria Elimination Network training course in vector surveillance on the River Kwai in Thailand in 2018 with representatives of six Asia-Pacific countries, which trained participants in different trapping methods.

"...with good people,  
you can overcome  
many things."



*Field mosquito trap training in Thailand*



## TROPICAL PARTNERS FOR IMPROVED HEALTH SECURITY

Health professionals and policy makers will be able to watch a hypothetical global pandemic unfold on a world map using an online tool developed for a major health security project.

AITHM Professor Emma McBryde has led development of the Global Pandemic Model. It is one part of the extensive and collaborative Tropical Partners project, which has three main parts – creation of tools for health professionals and policy makers to reduce health security risks; collection and sharing of data and best practices throughout the Indo-Pacific; and research training and network building. Professor McBryde said access to up-to-date and policy-relevant information was a key component in preparedness and response to emerging infectious diseases. Users of the Global Pandemic online tool can select a source country as the origin of a pandemic, and visualise predicted pandemic spread for emerging pathogens such as Ebola virus.

“A spatial approach can use data to communicate risks and undertake scenario planning with a geographic focus, and allow real-time updates to support planning and decision-making during public health events,” said Professor McBryde. “Visualisations for our model are based on compartmental meta-population models of infectious disease transmission, integrated with international flight travel data from (air travel intelligence



and data provider) OAG, and presented on an open web-based graphical user interface.”

The Tropical Partners project is funded through the Department of Foreign Affairs and Trade’s Indo-Pacific Centre for Health Security, and many teams from AITHM have been working on different aspects of the project in 2018 throughout Papua New Guinea, Australia, the Solomon Islands, Timor L’este, Indonesia and Fiji. The project wraps up in 2019.

Other Tropical Partners activities included several projects that mapped regional risk for emerging and re-emerging infectious diseases. The teams developed ‘vital signs’ tracking tools for national and provincial-level health system preparedness in the Solomon Islands using routinely collected health system data. They have also delivered structured operational research training to 53 key health professionals from five nations.

## EXCRETA IS THE ANSWER: IMPROVING SURVEILLANCE OF MOSQUITO BORNE DISEASE

Mosquito poo is a key ingredient in a number of projects that aim to enhance surveillance of mosquito-borne diseases in Northern Australia.

PhD student Ana Ramirez, working as part of AITHM's public health entomology team and in collaboration with Dr Andrew van den Hurk and other staff at the Public Health Virology (PHV) laboratory at Queensland Health's Forensic and Scientific Services, has confirmed that mosquito excreta can be analysed to detect a range of pathogens, including dengue, Ross River fever, Murray Valley encephalitis, West Nile virus and malaria. Her research has shown that pathogens show up in mosquito excreta earlier and in greater volume than in mosquito saliva. This means that an excreta-based virus surveillance system would provide earlier warnings and increased sensitivity than existing saliva-based systems.

Research Fellow and biologist Dr Dagmar Meyer Steiger, also a member of AITHM's public health entomology research team led by Professor Scott Ritchie, is developing and field trialling traps designed to catch female mosquitoes and harvest their excreta.

Dr Meyer Steiger's work around mosquito trap development builds on other researchers' findings that mosquito poo can be used effectively to monitor spread of pathogens.

"You can capture and transport live mosquitoes – which have to be kept cool at all times – to laboratories for

analysis, or take regular blood samples from sentinel animals, usually chickens... but these methods are both expensive and time consuming," said Dr Meyer Steiger, whose current research is funded by a HOT NORTH Early Career Research grant from the Menzies Institute for Medical Research.

"Viruses can be detected in mosquito saliva, but they only expel very small amounts, which makes detection difficult. So what other mosquito product could we collect that is provided in bigger quantities? The answer was excreta."

Despite Dr Meyer Steiger's success in collecting mosquito poo, the tiny excreta remained difficult to detect – until a PHV laboratory team member, Dr Sonja Hall-Mendelin, came up with an eye-catching solution.

"We put blue food dye in the honey fed to our mosquitoes, so their excreta turned blue. If you look at mosquitoes that have consumed the honey, their bellies are actually blue as well," said Dr Meyer Steiger.

Dr Meyer Steiger currently uses carbon dioxide (CO<sub>2</sub>), derived from dry ice or from gas bottles, to lure female mosquitoes into her traps, where honey-soaked cards provide a feast to encourage poo production. Traps contain special filter cards or polycarbonate sheets to collect the excreta and preserve the viral RNA it contains for later laboratory analysis. Her next goal is to simplify the traps, so they no longer require CO<sub>2</sub> gas or

a power source to operate, thus enabling the devices to be produced cheaply and deployed on a large scale in even the remotest locations in Australia.

### Insectary facilities

AITHM Cairns has two insectary Facilities, the Tropical Medicine Mosquito Research Facility (TMMRF) funded by the Bill and Melinda Gates Foundation, and a specialist PC2 insectary laboratory. The TMMRF houses a laboratory and two large semi-field flight cages, used to simulate the natural environment and allow researchers to trial trapping and release strategies. These facilities have been used to house and produce large numbers of mosquitoes such as the dengue vector *Aedes aegypti* for programs including the Verily Debug Project, the Eliminate Dengue Project and various other research programs.

*"Viruses can be detected in mosquito saliva but they only expel very small amounts... So what other mosquito product could we collect? The answer was excreta." Dr Dagmar Meyer Steiger*







## GROWING THE TROPICAL AUSTRALIAN ACADEMIC HEALTH CENTRE PARTNERSHIP

Northern Queensland's hospitals and health services, together with JCU and AIITHM, have pooled expertise and resources to bring into existence the Tropical Australian Academic Health Centre (TAAHC) Company in 2018.

Academic Health Centres are research partnerships between universities and health providers. Combining clinical knowledge, academic input and resources supports the promotion of research that directly addresses the challenges faced by clinicians and communities, and offers the potential to streamline research processes.

Five hospital and health services (Townsville, Mackay, Cairns and Hinterland, Mount Isa, Torres and Cape), JCU, including AIITHM and the North Queensland Primary Health Network in 2018, committing funds and identifying the priorities and challenges that will guide the work of TAAHC over the coming years.

TAAHC has refined its focus in 2018. Members from the hospitals, JCU, AIITHM and health services identified four major challenges around which more research is needed:

- The need to provide services across a vast geographic area to a highly-dispersed population with a significant proportion of Aboriginal and Torres Strait Islander people
- A chronic disease burden that is, per capita, greater than the Queensland average, and correspondingly, a population that is less healthy than the Queensland average
- Current and projected clinical workforce shortages
- A location-induced health security risk from infectious disease incursions across the north-ern Australia border.

One of the first items of business for the TAAHC Company has been to renew its bid for recognition by the National Health and Medical Research Council (NHMRC) as a Centre for Innovation in Regional Health, with a submission lodged in 2019.



## SEARCHING FOR A SIMPLE BLOOD TEST FOR STROKE

Diagnosing stroke quickly enough to start life-saving treatment is difficult, and the problem is exacerbated in rural and regional areas like Northern Queensland where it might take patients many hours to reach a hospital.

JCU AITHM Research Fellow, Dr Joseph Moxon, is working on research to develop a rapid diagnostic blood test for ischemic stroke, a condition that is difficult to diagnose quickly with current available methods.

Dr Moxon is in the midst of a clinical trial, working with nurses in the Townsville Hospital and Health Service neurology unit, to collect blood samples from suspected stroke patients, which are then tested and analysed for the presence of a particular protein that shows potential as a stroke biomarker.

"Techniques that restore blood flow for stroke sufferers must be delivered within four-and-a-half hours of the onset of stroke for the patient to have their best chance at survival and recovery," said Dr Moxon. "But stroke is diagnosed currently with imaging and specialised examination, which can take time. If you are in Weipa and you're nowhere near facilities that can do this type of testing, you will be very lucky to receive the treatment in time."

"What we're trying to do is develop a simple (blood) test that can be delivered by someone such as a general practitioner so that treatment can be started as quickly as possible; that's the dream and the ultimate end goal," said Dr Moxon.

Dr Moxon's project follows on from earlier work in which analysis of data from laboratory models and

patients identified a group of blood-borne molecules that change rapidly following stroke onset. The earlier study compared the blood samples of healthy people with those of people who had experienced a stroke. The researchers noticed that a particular protein associated with regulating the blood-brain barrier was found in high levels in healthy patients, but was low in stroke patients. Patients with the lowest levels of the protein were those whose outcomes were poorest.

Dr Moxon said the reason for the difference in the protein levels was unknown and he hoped to validate a relationship between the protein and occurrence of stroke using information gained from the Townsville Hospital study.

"The stroke nurses in Townsville have been the real heroes of this project so far. They are helping with recruitment of patients and collecting of samples and I cannot think of high enough praise to describe their work," said Dr Moxon.



*Dr Joseph Moxon in the AITHM Translational Research Facility*

THHS has North Queensland's only stroke unit, servicing an area in excess of 750,000 square kilometres. Approximately 250 suspected stroke cases present each year to the hospital and around 80 per cent are confirmed as stroke. The recruitment phase of Dr Moxon's project will run for two years, wrapping up in late 2019 when analysis can begin. Dr Moxon's research has been enabled through an Advance Queensland Fellowship, which he was awarded in 2017.

## THE SEAT OF THE PROBLEM

Ergonomist, Associate Professor Gunther Paul, is at the forefront of developing customised wheelchair seating to reduce patients' risk of pressure ulcers, an escalating burden on healthcare systems around the world.

"Pressure ulcers are not just debilitating and extremely painful, they are potentially lethal. The prevalence of this condition is increasing and the average cost of treating a patient is around \$180,000," said Associate Professor Paul, a former leading car seat designer, who now works as a Principal Research Fellow in Occupational Health and Safety.

"We would love to take it to the point where we can serve patients, before they start suffering pressure ulcers."

In 2017, he embarked on a joint project with Queensland Health's Rehabilitation Engineering Centre, based at the Royal Brisbane Hospital, to explore how science and technology could efficiently deliver effective seating cushion solutions for patients, who often wait months for a finished product, under the current "trial and error" approach to customised seating modifications.

Associate Professor Paul and his co-researchers set about taking the guesswork out of seating design by developing a simulation process that accurately identifies how an individual human body in a seated posture

interacts with varying forms and compositions of foam cushion material.

The first step was to construct a rigid, aluminium "indenter" device equipped with a three-dimensional (3-D) force gauge to measure the reaction force of the foam under pressure. This gauge can be programmed to indent the foam for a specific period or until a particular force or depth is reached.

The second challenge was to create 3-D printed shell replicas of individual human pelvises, to attach to the "indenter" during trials.

Associate Professor Paul has successfully translated the current physical trial into a virtual computer-based test, which opens the door to even faster results for patients in sore need of rapid assistance.

The next step is commercialisation of the design process, which ideally would automate and further speed production, enabling those in wheelchairs to readily access appropriate seating in time to ward off the threat of pressure ulcers.

"Prevention is the big goal," he said. "We would love to take it to the point where we can serve patients before they start suffering pressure ulcers."



*Associate Professor  
Gunther Paul and  
colleagues*



## MAKING HOSPITAL DATA COME ALIVE

The masses of patient data collected by different departments of Townsville Hospital contain many hidden answers to medical and health questions.

The answers, however, stay hidden unless the data can be linked up, organised and interrogated, which is exactly what is being done by a team of researchers, data scientists and clinicians from AITHM, Townsville Hospital and JCU's College of Medicine and Dentistry.

Professor Damon Eisen of JCU's College of Medicine and Dentistry said the team was focussing its attention on data for patients admitted to Townsville Hospital with infectious disease codes over an 11-year period between 2006 and 2016.

Data sources included the Queensland Admitted Patient Data Collection, Emergency Department Information Services, Pathology Queensland, pharmacy dispensing data, notifiable conditions and the National Death Registry. Once these data sources have a linkage code, they are anonymised.

The cohort includes more than 41,000 patients with nearly 380,000 admissions, around 2 million pathology results, and more than 1.8 million diagnostic/procedure codes.

"All of those pieces of information come together to provide a rich and detailed picture of individual patients and groups of patients. We can use it to consider a whole range of conditions," said Professor Eisen.

Some questions the team have begun asking of the data

relate to mortality in different demographic groups. They have also linked additional data from the Bureau of Meteorology with that of pneumonia patients to examine the impact of climate on pneumonia incidence in the Northern Queensland region.

"The organisation of the data is challenging. We have had a very brilliant data scientist finalising a relational model so that clinicians can readily use this resource ... giving them an interface to get a read-out on questions they might have can make the data come alive," said Professor Eisen.

The team working on the data linkage project includes AITHM Professor Emma McBryde, AITHM Research Fellow Dr Oyelola Adegboye, data scientist Matthew Murray and clinicians from Townsville Hospital.

Professor McBryde said other plans for the data included auditing the number of people with rare diseases (e.g. melioidosis) or severe outcomes (e.g. acidosis/ICU admissions) and examining risk factors for these.

"We are also very interested in the impact of being rural/remote on outcomes and the impact of resistance on outcomes. We plan to interrogate the database using machine learning algorithms to see if this provides any additional insights into predictors of death," said Professor McBryde.

Machine learning approaches will allow the team to use

the data that has already been collected to "train the machines" to identify and predict problems and patterns of diagnosis that are occurring in real time.

### Townsville Hospital infectious disease admissions data snapshot

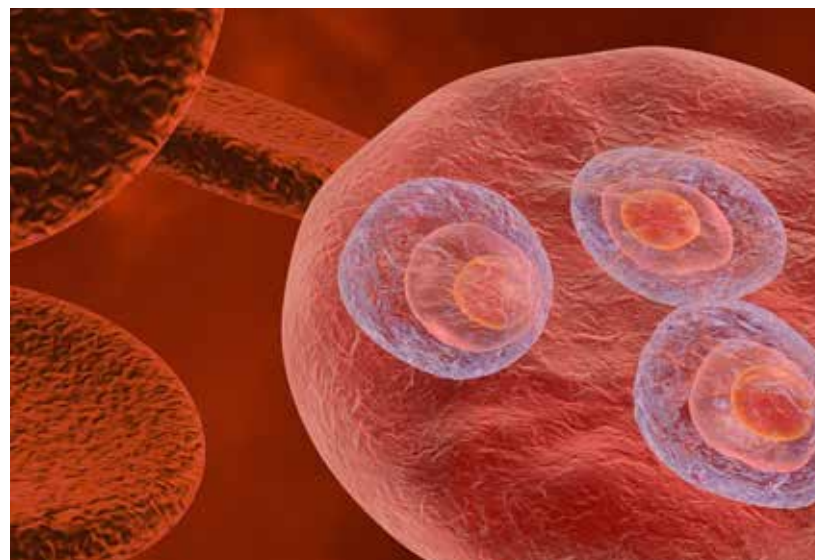
- Mortality for the cohort over the 11-year period was **20%**
- The age and sex adjusted mortality ratio for this cohort was **5.26** times greater than the general Queensland population
- The commonest comorbidities were smoking (**44%**), chronic renal disease (**18%**), diabetes (**17%**), cancer (**14%**) chronic and pulmonary disease (**12%**)
- Nearly **15%** of the cohort identify as Aboriginal or Torres Strait Islanders
- Aboriginal and Torres Strait Islander people had a **17%** greater risk of dying than non-indigenous patients in the cohort.

## BANISHING A KILLER IN THE TROPICAL WORLD: NEW REALMS IN MALARIA RESEARCH

Efforts to develop a vaccine for malaria have been stepped up as cutting-edge technology opens up new possibilities for researchers. AITHM is a significant global player in malarial research, and the Institute is working on three vaccines at various stages of development.

AITHM Deputy Director Professor Denise Doolan says faster and more sophisticated technology is allowing researchers to analyse all aspects of the parasite's make-up, and the human body's response to a malaria parasite invasion in a way that has not been possible before. Her research group is exploring the genetic blueprint of the malaria parasite with a view to providing a comprehensive picture of the interactions between the parasite and its human host. Professor Doolan is part of a consortium of malaria researchers and product developers in Australia, Europe, the USA and Africa who are working to move new vaccine leads to clinical testing as quickly as possible.

In another vaccine development project, AITHM Director Professor Louis Schofield's research team has developed a prototype vaccine aimed at overcoming the complexity and challenges presented by a disease that is caused by several different species with multi-stage life cycles. The project is innovative on several fronts. The saccharide-conjugate vaccine attacks a universally



conserved target present on the surface of most stages and all species of the malaria parasite. In pre-clinical testing, the vaccine has shown effectiveness against the invasive sporozoite stage, replicating blood-stage and transmissible sexual stage of malaria. As such, it appears to meet the endorsed Target Product Profile for an eradication vaccine.

AITHM's third malaria vaccine candidate, also led by Professor Schofield, has completed Phase 1 clinical trials in Queensland in collaboration with Professor James McCarthy from QIMR Berghofer. The vaccine is a genetically attenuated live blood-stage malaria vaccine in which pathogen virulence factors have been ablated. Further investment will allow Phase II testing of this candidate vaccine.



## PARASITES

Distinguished Professor Alex Loukas is leading research to analyse parasitic worms and flukes common to the Tropics, and the secretions and reactions that these parasites produce in their human hosts. He said that whilst many parasites were responsible for significant disease and illness in humans, they might also be the source of much potential good. In related research in 2018, Dr Michael Smout, working with Professor Loukas and Professor Norelle Daly and teams, have made key discoveries related to the deadly Thai liver fluke, *Opisthorchis viverrine*, that causes liver cancer. The team has been studying the potential of a molecule secreted by the potentially deadly Thai liver fluke to, ironically, promote healing. They discovered that its most deadly molecules can be recreated synthetically, and used as a supercharged healing agent.

## BLOOD FLUKE DIAGNOSTICS

Schistosomiasis is a disease caused by a parasitic blood fluke which affects hundreds of millions of people throughout the developing Tropics. A project jointly funded by Merck and Austrade and led by AIITHM researchers Dr Mark Pearson and Professor Alex Loukas, has identified novel proteins from the offending worm that have been shown, in laboratory settings, to diagnose schistosomiasis in humans more effectively than current gold-standard methods. The researchers will now turn their attention to developing these proteins into a new rapid and sensitive diagnostic test for schistosomiasis, which aims to improve the lives of the millions of people suffering from this debilitating disease.

## Irradiator facilities

AIITHM facilities are host to both gamma (Townsville) and X-ray (Cairns) irradiators, used for the irradiation of parasites, cell lines and other biological samples for a host of different research purposes. The RS2000 Cabinet X-ray Irradiator (Cairns, pictured) is the only X-ray irradiator approved for use by Radiation Health Queensland.





## EDITING THE GENES OF CANCER-CAUSING PARASITES...

A new gene editing technique that gained notoriety in 2018 when used on human embryos in China has been put to use by Dr Michael Smout and colleagues to analyse the way one tiny molecule type from a parasite can both harm and heal. The term 'CRISPR-Cas9' was not widely known outside the genetics community until a Chinese scientist reportedly and controversially used the technique to 'edit' the genes of unborn twin sisters to prevent them from developing HIV infection later in life.

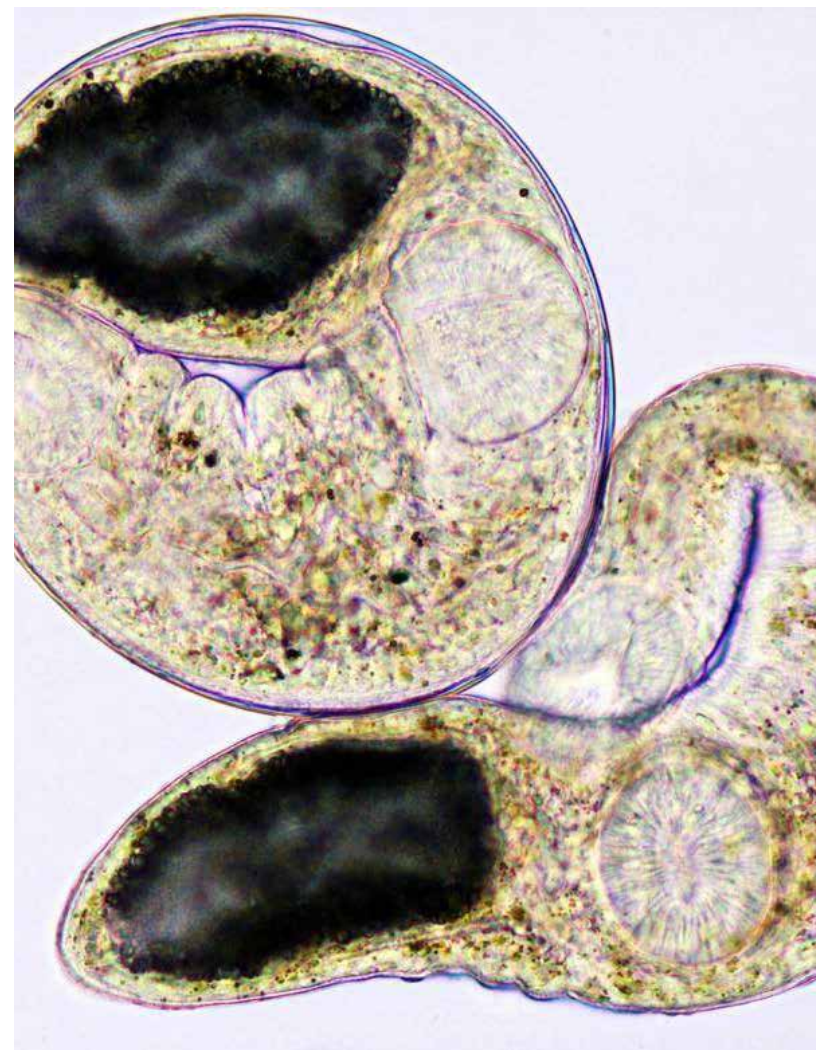
The modern gene editing technology is opening up new avenues of inquiry and potential. For Professor Alex Loukas and Dr Smout, in collaboration with groups at Khon Kaen University in Thailand and George Washington University in the United States, CRISPR-Cas9 means the possibility of reducing instances of liver cancer.

"Our findings are the first report of the use of CRISPR-Cas9 to address gene function in parasitic flatworms, so we expect great interest from the helminthology community at large," said Professor Loukas.

The Thai liver fluke is transmitted to humans through consumption of raw or fermented fish from the lower Mekong River Basin in South East Asia. One of the most harmful potential outcomes for an infected human host is developing liver cancer. Professor Loukas explains, "This fluke is a half-inch long parasitic flatworm that crawls into the bile ducts, the drainage system of your liver. Here, it secretes molecules that have evolved to keep the worm alive for decades. One of these mole-

cules is a growth factor named granulin. It stimulates wound healing and we suspect also helps the worm reduce the damage it causes by grazing on your liver tissue. This repeated cycle of wounding and healing leads to a build-up of fibrous collagen, a process similar to scarring. A scarred liver is a precursor to liver cancer."

With the modern CRISPR gene editing techniques the team can explore the effects of knocking out the granulin gene from the liver fluke's genome and assess the impact on liver scarring. The team's research has shown that the gene-edited flukes produced less granulin protein, which, in turn, produced less cell proliferation, slowing down the harmful wounding-healing process.



## ...AND USING A DEADLY PARASITE FOR GOOD



On one hand, the Thai liver fluke is a parasite that can cause a deadly cancer. On the other, it produces a molecule that supercharges healing – a finding with great promise for people with non-healing wounds.

AITHM scientists from several different research teams had been developing a promising treatment for chronic wounds for several years based on the reproduction of a granulin molecule secreted by the Thai liver fluke. Dr Michael Smout said the team, which also includes Professor Norelle Daly and PhD candidate Mohadeseh Dastpeyman, had built its own synthetic model of the granulin peptide, refining it in 2018 in a way that has almost doubled its healing power.

Their first version demonstrated potent wound healing in mice, and achieved good results with lab-grown human cells, but the latest 2018 model shows even greater promise.

AITHM researchers have rebuilt the molecule, piece by piece. “In biology the structure and fold of a molecule can be critical to its function and stability, and NMR spectroscopy revealed that this molecule is quite complex in terms of its structure,” said Professor Daly.

“Our focus has been on refining the structure,” Mrs Dastpeyman said. “We identified those elements of the granulin molecule that are critical to healing, and incorporated them in a synthetic peptide that will be reliably stable.”

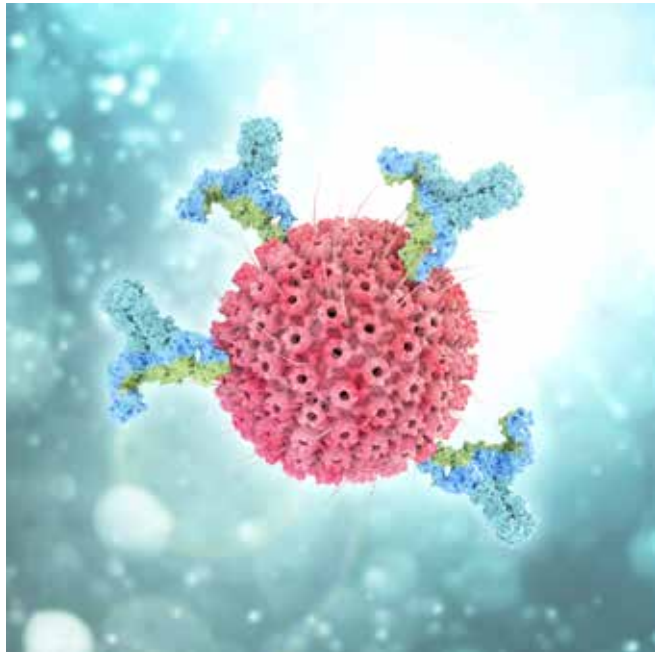
Dr Smout said the rebuilt peptide, currently known as P4A, had demonstrated double the healing power of

the first synthetic version. In tests P4A improved wound healing by 43 per cent in mice. The patent application for P4A was published in March 2018.

The next phase of the project is to secure funding partners to help progress from lab-based success to clinical trials and ultimately give hope to patients who face the devastating prospect of losing limbs because of non-healing wounds.

“Every day 12 Australian diabetics have a limb amputated because of a chronic wound. Globally, it’s one every 30 seconds. We’re confident we have a very strong contender for what could one day be a cream that a diabetic could apply at home, avoiding a long and costly hospital stay and possible amputation.” Dr Smout said.

## FIGHTING WITH THE FLU AGAIN? BLAME YOUR PARENTS



**A**ITHM Principal Research Fellow, Associate Professor John Miles is investigating genes that affect immune response to viruses. "If we can identify the exact genes involved in tuning the strength of our immune response, we can utilise them to design next generation vaccines," he said.

Working with researchers from the University of Queensland's Diamantina Research Institute, the team studied 1835 adolescent children participating in the Brisbane Longitudinal Twin Study, conducted by the QIMR Berghofer Medical Research Institute.

They measured antibody levels against six common viruses to determine the relative importance of genetic and environmental factors. These included Epstein-Barr virus, coxsackie B virus, parvovirus, herpes simplex virus, human herpes virus 6 and cytomegalovirus.

The study found that identical twins, who share the same DNA, showed greater similarity in the level of antibodies released in response to the viruses than fraternal twins with differing DNA. The results indicate that genetic factors play a large role in how effectively and efficiently the body generates and deploys antibodies.

"We were surprised to see that the 'power' of your immune system is predominantly controlled by the genes passed down from your mother or father,"

Associate Professor Miles said. "These genes determine whether you mount an intense or weak immune response when confronted with a viral infection."

"While these viruses usually cause relatively mild or no symptoms, they have been linked to more severe diseases, including multiple sclerosis, rheumatoid arthritis, type 1 diabetes and systemic lupus erythematosus," Associate Professor Miles said.

Professor David Evans, Diamantina Research Institute Senior Research Fellow, said environmental factors shared between the twins appeared to be more important in determining whether individuals were infected with a particular virus, whereas genetics largely determined the response to the infection

The researchers are keen to use their study findings as a stepping stone to further research into links between viral infections and autoimmune diseases.

"Our intention is to use individual genetic variants that we discover from future genome-wide association studies as genetic instruments to investigate possible causal relationships between infection by these viruses and the development of autoimmune disease," said Professor Evans.

"We were surprised to see that the 'power' of your immune system is predominantly controlled by the genes passed down from your mother or father."





*Professor Zoltan Sarnyai*

## FOOD FOR THOUGHT

Neuroscientist, Professor Zoltan Sarnyai, is exploring the intricate influence of specific foods on brain function, and their potential to delay or even prevent the onset of a range of mental health conditions, including depression.

"It is really important to understand that food is a collection of chemicals that interact with our entire body, including our brain," said the JCU Professor of Pharmacology, who also heads the Laboratory of Psychiatric Neuroscience.

Professor Sarnyai and fellow AITHM investigator, Professor Robyn McDermott, recently identified a striking relationship between depression and diet in a study of two Far North Queensland communities, one of which had access to multiple fast food outlets, while the other had none, and relied more on meals featuring fresh-caught seafood.

More than 200 residents from the two communities completed both dietary and mental health questionnaires. Blood samples supplied by the study participants provided independent verification – at a biological level – of the types of food they had consumed in the preceding week.

Those people who ate more seafood showed higher levels of omega-3 fatty acids in the membrane of their red blood cells, and lower levels of omega-6 fatty acids, while the reverse was true of those who consumed large quantities of junk food. The correlation with self-reported mental health symptoms was profound.

"These people lead reasonably similar lives, but there was a dramatic difference in scores using the depression psychological scale," Professor Sarnyai observed. "In the community that eats more seafood, we identified only a very small number of individuals showing signs of depression, compared to a much higher number in the community that favours junk food."

Correlation is not confirmation of cause. An intervention study, comparing a control group on a standard diet, with an intervention group on a high seafood diet, would shed greater light on whether seafood consumption decreases the likelihood of developing depression-like symptoms, according to Professor Sarnyai. He believes the stakes are high to develop tools other than pharmaceutical drugs to tackle the rising incidence of mental health disorders.

"Nutritional psychiatry is becoming a more mainstream approach which could help manage individuals with mild to moderate symptoms of anxiety, depression and even some of the psychotic disorders," he said.

"You can try to find the active ingredient of a food and develop a drug from that, or you can acknowledge there might be a number of active ingredients that we don't have to identify. We just need to understand that eating a certain type of food has beneficial effects, and if we have proper scientific evidence to back it up, then we should promote it."



## STUDYING SUSCEPTIBILITY TO NTM LUNG INFECTION

Why are some people more susceptible to developing the increasingly common bacterial lung infection non-tuberculous mycobacteria (NTM)? That is the question posed by a team of AITHM researchers as NTM becomes an escalating public health concern worldwide, particularly in the Tropics.

NTM is commonly caused by a bacterium found in soil and water. New evidence of person-to-person transmission of multidrug-resistant NTM is adding to national and international concern. In North Queensland, AITHM's backyard, incidence of NTM in Queensland has increased by 17 per cent a year between 2012 and 2015. AITHM Associate Professor John Miles said the reason why certain individuals were at risk of NTM infections was unknown. However, the research team has identified defects in immune system function that predispose some people to developing NTM disease. AITHM researchers are now trialling immunotherapeutic drugs to correct these defects.

*Associate Professor  
John Miles*

## STREAMLINING THE 'NO JAB, NO CHILL' VACCINE PLATFORM

Work continues at AITHM to solve two problems that hinder access to vaccines in the developing world: they need to be kept cool, and no one likes needles. Associate Professor John Miles and colleagues in Wales have been working on a synthetic vaccine platform that can be stored at room temperature and taken by mouth. They

have tested a synthetic influenza vaccine, and have used their findings to further revise and streamline the model in 2018. "Streamlining the platform means we can expand research out of influenza to other diseases such as cancer causing viruses," said Associate Professor Miles.





## A TALE OF TWO SCIENTISTS

On the surface, it seems an unlikely collaboration. Working together are two scientists – one who is infecting people with hookworms to treat coeliac disease, the other working on a vaccine against hookworms. Look a little deeper and it makes sense on a number of levels.

AITHM Senior Research Fellow and Mucosal Immunologist Dr Paul Giacomini is in the midst of clinical trials using low doses of hookworm infection to attempt to treat coeliac disease... whilst QIMR Berghofer Medical Research Institute infectious disease clinician Dr Paul Chapman is testing the first-ever live vaccine against hookworm. Whether a clinical trial is for or against hookworms, two common factors must be taken care of: the need to ensure a steady and safe supply of hookworms, and the need to understand whether hookworm infection is safe and how it affects the human host's immune system.

As part of his clinical trials, Dr Chapman needed to establish QIMR Berghofer as a safe facility for growing, testing and harvesting hookworms for human trials. Dr Giacomini said he and AITHM's Professor Alex Loukas were involved in the trial design for QIMR's live hookworm vaccine. They are also leading the analysis of the immune responses in the vaccinated people involved in the QIMR clinical trial to identify the mechanisms of how the vaccine may work to protect people from hookworm infections.

Analysis in Dr Giacomini's own coeliac disease clinical trial is progressing simultaneously. Dr Giacomini said 54



*Dr Paul Giacomini*

people with a proven diagnosis of the inflammatory gut disease, coeliac disease, took part in the double-blinded placebo controlled trials conducted in collaboration with Prince Charles Hospital, Logan Hospital, Townsville Hospital and Christchurch Hospital. The primary clinical phase of the 10-month trial was completed in early 2019. The trial will allow researchers to better understand whether hookworm infection will allow people with the disease to gradually reintroduce gluten-containing foods into their diets. Researchers are analysing samples and data collected during the trials and expect to write up their findings in 2019.

## HOOKWORM PROTECTION FOR DIABETES

A Cairns-based clinical trial is testing the potential of hookworms to protect against type 2 diabetes. The project grew out of an earlier finding that mice infected with hookworms were somehow protected against developing metabolic diseases such as type 2 diabetes. It was posited that the reason for this protection could be attributed to the release of anti-inflammatory molecules and/or promotion of beneficial changes in the gut microbiome, which together may control metabolism. A grant from the Far North Queensland Hospital Foundation and State Government Network Funds has enabled Dr Giacomini and colleagues to conduct this world-first human trial. The team began recruiting clinical trial participants in Cairns in late 2017 and is aiming to reach its target its target cohort of 45 people in 2019.

## RAY OF HOPE FOR FISH ALLERGY SUFFERERS

Stingray flesh from a European ray species might be a potential seafood substitute for sufferers of fish allergy, according to AITHM immunotherapy researchers and collaborators in Europe. The team made the surprise discovery in 2018 that European ray species, which have a cartilaginous skeleton, are less allergenic than their fishy counterparts with bony skeletons. "Although Australians do not commonly consume rays, stingray flesh is served in restaurants and fish shops across Europe and South East Asia," said JCU Molecular Allergy Research Laboratory researcher, Dr Aya Taki.

Fish allergy is one of the most common food allergies worldwide and cannot be outgrown, unlike allergies to egg or milk. The researchers, whose study included a clinical trial, discovered that the major fish allergen, called parvalbumin, is much less allergenic in the flesh of rays. Most of the fish allergy sufferers who were tested in the trial could safely eat rays.

"Despite having a proven allergy to fish, 10 out of 11 patients were able to eat ray without suffering any signs of an allergic reaction," said Dr Taki. "There is a great hope that the millions of patients living with the fish allergy can soon consume fish in their daily diet for healthier living." Fish allergy is a life-threatening disease because of the frequency with which sufferers experience anaphylactic shock. There is no cure and people suffering from fish allergy must avoid any food potentially containing fish.

JCU AITHM's Dr Taki and Professor Andreas Lopata are working to tackle fish allergy with researchers from the Medical University of Vienna, Professor Heimo Breiteneder, and the Institute for Pathophysiology and Allergy Research, Ms Tanja Kalic. The international research team behind the ray discovery also includes scientists from Australia, Luxembourg, Denmark and Austria.

*European Thornback Ray*



## WORKING TOGETHER

Tackling community health and wellbeing issues such as obesity and chronic disease requires many partners. JCU, AITHM, and Apunipima Cape York Health Council have been working together for more than five years to help improve health and nutrition in the Cape. One long-standing collaboration, a trial of the Getting Better at Chronic Care model led by Professor Robyn McDermott, concluded in 2018.

The randomised cluster trial involved community health workers delivering diabetes care and promoting self-management among high-risk clients in 12 remote North Queensland communities. The trial showed a modest improvement in clinical indicators and a significant reduction in severe diabetes-related hospitalisation. It has been modified for further multi-centre trials in North Queensland and the Northern Territory in 2019 in collaboration with Menzies School of Health Research.

## CONNECTING RURAL QUEENSLAND TO CANCER TREATMENT TRIALS

A Queensland teletrial model, which is allowing rural and regional cancer patients access to clinical trials via video link and telecommunication, recruited its first participants in 2018. Architect of the model, Professor Sabe Sabesan of Townsville Hospital and Health Service, Icon Cancer Care, JCU and AITHM said access to trials represented a new phase in teleoncology.

"In the past, drug companies have predominately targeted metro areas because the reach of potential patients was much higher," said Professor Sabesan. "By linking areas of North Queensland, we can increase the availability of suitable patients and really incentivise attracting cutting edge trials to our communities. There has been significant progress in treating cancers and it is important our communities in rural and remote regions are able to access the latest developments."

Professor Sabesan has developed and evaluated various teleoncology models of care to deliver rural cancer care closer to home. The tele-chemo model in which clinicians in North and Far North Queensland supervise chemotherapy services via videolink is delivered by nurses and local health professionals in Thursday Island, Cape York, Bowen and Ingham. Based on the success in North and Far North Queensland trials of this model, it has now been adopted by Queensland Health and rolled out across the state as the Queensland Remote Chemotherapy Supervision (QReCS) model.



*Professor Sabe Sabesan*





## CHRONIC DISEASE MANAGEMENT SHOULD NOT BE AN EMERGENCY

Coordinated, tailored and patient-centred approaches are key to our future healthcare needs, and PhD student Mary O'Loughlin is using the perspectives of people living with chronic conditions to find ways to improve health services in the Cairns community.

"My research is about making the system work for local people, and I gather face-to-face viewpoints about the patient-journey, which gives people a voice by finding out what they think and what they need," Ms O'Loughlin said.

Ms O'Loughlin's PhD research, supervised by Dr Linton Harris, Professor Robyn McDermott and Associate Professor Caryn West, differs from other studies by using existing administrative data sets from Cairns Hospital and linking them with the outcomes of a patient survey on reasons for presentation to the emergency department. It builds on an earlier project by Professor Jane Mills.

"As part of a wider mixed methods project, I conducted 21 in-depth interviews, which were supported by money from a FNQ Hospital Foundation Grant. There is a lack of evidence reported from the patient perspective on whether or not their hospitalisation or emergency presentation could have been prevented, so my interviews

explored these areas and found out which elements of the Federal Government's Health Care Home model are of value to patients. The outcomes will inform my PhD and in turn will improve service delivery for people in Cairns," Ms O'Loughlin explained.

"My research is about making the system work for local people."

"Cairns Hospital, the North Queensland Primary Health Network and other Primary Health Networks (PHN) from across Australia have shown interest in the study and how they can use the findings

to benefit those with chronic illness."

A Health Care Home is a general practice or Aboriginal Community Controlled Health Service (ACCHS) that coordinates care for patients with chronic and complex conditions. There is currently a nationwide trial of the model, which promotes tailored care and flexible ways of working. Importantly, it also has a different payment system, moving away from the existing fee-for-service model to a lump sum payment from Government for the coordination of a range of care services.



in partnership with

## ABORIGINAL AND TORRES STRAIT ISLANDER RESEARCHERS

### RESEARCHING OUR WAY BACK TO LIFE

Communities of the Torres Strait and Northern Peninsula Area (NPA) are stepping up efforts to set their own health research agendas. A call by Torres Strait health and community representatives in July 2018 to help build research capacity in the north was amplified later in the year at the AITHM Thursday Island opening ceremony.

AITHM and its partners have responded by developing a series of research capacity-strengthening workshops for delivery in 2019. Twenty-two people signed up for the workshops, including health workers, community representatives, nurses, doctors and allied health practitioners. Chair of the research sub-committee Torres Straits and NPA and late Elder, Romina Fujii, said the workshops would be invaluable for the highly motivated professionals who have signed up to learn more.

"Research is very important to all people in the Torres Strait, NPA and around the world. Health issues and prevention is critical to all our people, youth to seniors, to create healthy communities," said Ms Fujii.

AITHM's Professor Malcolm McDonald is leading the planning and delivery of four two-day workshops, to take place on Thursday Island over a 12-month period in 2019. The format was inspired by a community elder who said "we have been researched to death; maybe it's time we started researching our way back to life."

"The intention is to foster home-grown research skills; the workshops aim to support each participant

to achieve a research output that addresses a topic of importance to their health practice or their community by the end of the year. We had many people wanting to participate," said Professor McDonald. The workshop series will begin with 'asking the right questions' and conclude with 'the results', and has been developed with a Workshop Consultative Group of senior Torres Strait Islander and Aboriginal community members to ensure the material and approach suits local cultural and health needs. Local community ownership is key.

"We're careful not to call this a project; projects come to an end," said Professor McDonald. "This is a beginning. This is a long-term investment in the research capability of the region and health of the people."



*Thursday Island research workshop*

## COUNTING THE COSTS: CANCER DIAGNOSIS FOR ABORIGINAL AND TORRES STRAIT ISLANDER PEOPLE

The financial costs of a cancer diagnosis are particularly high for those living in remote and regional areas of Australia. A multi-institutional team of researchers, led by Professor Sarah Larkins and Associate Professor Stephanie Topp, is investigating the type of out-of-pocket expenses incurred by Aboriginal and Torres Strait Islander people in our region and how these costs can influence access to treatment.

"People living in remote areas often have to travel long distances or even relocate for cancer treatment. Our research team is looking at this burden from the perspective of Queensland Aboriginal and Torres Strait Islander people who are having to access cancer treatment in Townsville and Brisbane," Associate Professor Topp explained.

The research is being conducted in collaboration with Professor Gail Garvey from Menzies School of Health Research and Associate Professor Emily Callander. The project aims to examine the commonalities and differences experienced by patients, their families and carers in Townsville and Brisbane. "Financially, the location of friends and family can have a huge impact, and having a community network near the hospital is a major benefit. However for many there is still a significant loss of income, and additional financial and emotional stress, associated with being away from home and work," Associate Professor Topp said. "Bills don't stop when you're on treatment."

Lead interviewer Ms Rachel Cummins spoke with as

"People living in remote areas often have to travel long distances or even relocate for cancer treatment."

many patients, service providers and carers as possible in Townsville to understand what costs patients and their carers experienced, the financial support services and subsidies available, and how financial out-of-pocket expenses interact with other costs to influence patients' decisions about whether and when to have treatment. The findings have been revealing. "There is

a raft of support schemes available from the Federal and state governments and the not-for-profit sector to help with out-of-pocket expenses for cancer patients. But knowing about them, and how to access them, is an obstacle for many people," Associate Professor Topp said.

"Hospital-based Indigenous Liaison Officers (ILO) currently play a central role in helping patients understand and access financial support; and without this support many patients would be high and dry. Yet many of these tasks lie beyond the ILOs' formal scope of practice, and the time it takes places enormous – probably unsustainable – pressure on these individuals. An increase in ILO power needs to be considered to recognise the important role cultural and practical matters play in patient care. Additional resources are also needed to help inform and link patients and carers to financial support services in order to produce a less-stressful experience for Indigenous patients," said Associate Professor Topp. "Overall, responsive health systems with appropriate workforce capacity are essential to support cancer patients in our community."



*Professor Sarah Larkins*



*Associate Professor  
Stephanie Topp*



## MUMS AND BUBS AND EMPOWERED WOMEN

Ten Aboriginal and Torres Strait Islander health services across Australia, together with women's groups in their communities and the support of JCU AIITHM researchers, are empowering mums to improve their own and their babies' health outcomes.

The Women's action for Mums and Bubs (WOMB) research project is being rolled out through 10 health services across four Australian states and territories: Queensland, New South Wales, the Northern Territory and Western Australia. It is a pragmatic trial that will train and support health services and community members to grow participatory women's groups for mums and babies.

The five-year project, funded by the NHMRC, was officially launched in 2018. Facilitators and researchers will work with the health services and communities to turn these plans into realities. JCU Associate Professor Catrina Felton-Busch, an Aboriginal researcher from Mornington Island and co-lead of the WOMB project said researchers and communities were committing to a strengths-based, nurturing approach by joining the project.

"Although there have been improvements in Aboriginal and Torres Strait Islander maternal and child health, inequities remain. This project will test the effectiveness of community women's groups to improve the quality of Aboriginal and Torres Strait Islander maternal and child health", said Associate Professor Felton-Busch.

Professor Sarah Larkins, co-lead from JCU, said the

researchers would examine the impacts of the women's groups and their ideas by monitoring child and maternal health outcomes such as quality of antenatal care and birth weights, as well as satisfaction with the processes.

"There is persuasive evidence internationally that shows participatory women's groups can improve maternal and child outcomes through improved quality of care, women's empowerment, and new learning," said Professor Larkins.

*Associate Professor Catrina Felton-Busch, speaking*



## RE-IMAGINING A BETTER LIFE AFTER TRAUMATIC BRAIN INJURY

Lives and minds can be changed in an instant after a traumatic brain injury (TBI), especially when someone you know or love causes the injury. Unsurprisingly, the change is often perceived as negative. Some people, however, re-learn and re-imagine their lives in a better way after TBI, untangling themselves, with help, from the complex set of circumstances that put them in harm's way.

Researchers at AITHM have been collecting and recording the recovery stories of Indigenous people in Northern Australia who have sustained a TBI. The NHMRC project, 'Transition from hospital to home: a longitudinal study of Aboriginal and Torres Strait Islander traumatic brain injury' was led by Dr India Bohanna and Dr Michelle Fitts, out of AITHM's community-based health promotion and prevention studies group, headed by Professor Alan Clough.

The aim of the study, which ended in 2018, was twofold. Firstly, it calculated and compared the annual rates of brain injury (per 100,000 population) for Indigenous and non-Indigenous Australians admitted to Townsville and Darwin hospitals using de-identified hospital administrative data sets. Secondly, researchers examined predictors of TBI events, and investigated their influence on health, wellbeing, community integration and transition experiences.

The research team identified common elements in the recovery stories of people who had made significant changes to their personal and social lives after their injuries. By identifying these elements, the team created resources to help others heal their lives after injury, as well as healing their brains.

Their findings about the rate of TBI in Northern Australian communities revealed just how important recovery support was. In the Northern Territory in 2017, the rate of TBI per 100,000 population for Indigenous men and Indigenous women was just over 700, compared to non-indigenous men, 282, and non-indigenous women, 130.

The team produced a series of videos, guides, booklets and resources for hospital staff and patients from their findings and interviews. Some of the artwork produced by TBI project participants has been donated to the Townsville Hospital and Health Service to help patients coming to hospital with TBI through sharing others' recovery journeys.

"We worked with 29 Indigenous people who had experienced TBI. Participants were invited to share their transition stories through photographs, videos, painting or other visual media. They were interviewed about their creations and short film stories were produced to be used as resources," said Dr Fitts.



## Healing and finding a purpose

Creative arts were used in the traumatic brain injury (TBI) transitions research project to help survivors to share their stories. Sharing these stories enabled survivors to educate others about the impact of TBI and to reconnect with their own families.

One artist and TBI survivor watched the final version of the film in which he featured together with his extended family. The artist reported that communication with family members had improved following the completion of the video:

"Now they're [sisters] saying 'I love you'. It's changed a lot. They don't say 'Yeah, okay, how are you going?'. They're saying 'how are you going [name]?' And I say 'Yeah good...they're very happy that I'm going forward with myself. (Artist)

A service provider who worked with the artist said the process of sharing personal stories and art also helped survivors to regain a sense of worth and purpose.

"I know that's one positive thing that he's looking at, the making of the video is that even if it helps just one other person out there understand and learn from what he's done in his life. And yeah, I know that that's how he feels. If somebody can learn from what he's done and make their lives better from not going down that same track that would make him proud," she said.

## BIOTECH START-UP COMPANY PARAGEN BIO LAUNCHED AT AITHM



**P**aragen Bio, the first biotech start-up for JCU and AITHM, was launched in August 2018 following a \$6M investment by AbbVie Ventures, Brandon Capital's Medical Research Commercialisation Fund and OneVentures. Paragen Bio Pty Ltd is one of just a handful of biotech companies in Northern Queensland. The \$6M investment into ParagenBio will advance the development of novel medicines sourced from hookworms to treat autoimmune diseases such as rheumatoid arthritis, inflammatory bowel disease and asthma.

Paragen Bio's technology is based on research with parasitic hookworms that has been conducted at AITHM by Professor Alex Loukas and his team for the past eight years. The technology was developed at JCU with support from the Australian Research Council, the Queensland Government, and the NHMRC.

Professor Loukas said the prevalence of hookworm infections in humans was slowly decreasing in many parts of the world because of a modern lifestyle and access to anti-worm therapies. This decrease in infection, however, has been linked to a rise in the incidence of autoimmune diseases - a range of diseases that cause the immune system to attack healthy tissues and organs.

"Through Paragen Bio we're being guided in our drug discovery efforts by millennia of co-evolution between parasitic hookworms and their mammalian hosts,

and in particular the effect hookworms can have on our immune systems," explained Professor Loukas. Worms in the human gut are recognized as foreign by our immune systems. Immune cells in the gut mount an inflammatory response in an attempt to eliminate the parasites. Hookworms, however, have developed a sophisticated armoury of molecules that they secrete into the gut to suppress inflammation and allow them to live for many years. These secreted proteins not only protect the worm from being eliminated by the immune response but also protect their human host against the onset of inappropriate immune responses, such as autoimmune diseases and allergies.

*Distinguished Professor  
Alex Loukas*





## WE HEAL, UHEAL, CHRONIC WOUNDS AND ULCER RESEARCH

The distressing problem of wounds that will not heal is a costly issue for tropical communities that have high levels of risk factor conditions such as diabetes and vascular disease.

AITHM is a key research partner in a new consortium, UHEAL, made up of scientists, clinicians and researchers working to improve care, develop therapeutics and reduce amputations associated with ulcers and non-healing wounds.

Led by Distinguished Professor Jonathan Golledge, the program involves a strong and diverse team of researchers from AITHM, JCU Colleges: Medicine and Dentistry, and Science and Engineering, the Indigenous Education & Research Centre, and JCU (Singapore). Project partners also include Townsville Hospital, Townsville Aboriginal and Islander Health Service, Cairns Hospital, Queensland University of Technology, AIT Ventures, A\*STAR (Singapore), Vapogenix (US), and NOVEL (Germany).

UHEAL researchers and clinicians have expertise in drug discovery, wound healing, animal models, disease mechanisms and clinical care, all of which is needed to improve chronic wound management.

Chronic wounds lead to pain, reduced quality of life and a high risk of amputation. The team recently identified that North Queensland had a leg amputation rate three times higher than the world average. The UHEAL team

estimated that major leg amputation rates in North Queensland were 300 per 100,000 in Indigenous and 70 per 100,000 in non-Indigenous patients, compared with worldwide rates of approximately 20 amputations per 100,000 people.

Professor Golledge said UHEAL was running an integrated bench to bedside program.

"This is a tropical health problem with accepted management deficiencies where there is enormous potential for improved patient outcomes and commercial development," said Professor Golledge.

Researchers will undertake activities that tackle all aspects of the problem from establishing a clinical study network to ensure sustainable clinical trials, to developing environmentally friendly thin-film dressings.

Research activities also include assessment of novel drugs and peptides which are expected to progress to clinical trials.

"UHEAL's vision is to substantially reduce the morbidity from chronic wounds in the Tropics by undertaking an integrated cross-disciplinary program of pre-clinical and clinical research focused on research translation and commercialisation," said Professor Golledge.

UHEAL is funded for three years through JCU's Strategic Research Investment Fund.

## BUZZ WORD IN DENGUE CONTROL

A mosquito's buzz is music to the ears of AITHM researcher Dr Kyran Staunton, who is fine tuning a sound trap designed to play a crucial role in efforts to control the spread of *Aedes aegypti* – the primary transmitter of dengue. Recent initiatives to reduce *Aedes aegypti* mosquito populations in Far North Queensland have focused on the release of *Wolbachia*-infected male mosquitoes, which do not allow females to reproduce, an approach that AITHM played a central role in developing through the early 2000's. This has triggered a demand for economical surveillance methods to keep tabs on the whereabouts of the males.

"Previous work by Professor Scott Ritchie's research team identified that the male mosquitoes were attracted to female wingbeat frequencies and can be captured in commonly-used traps through artificial playback of those sounds. But the traps were inappropriate for wide-scale monitoring," said Dr Staunton, a post-doctoral Research Fellow, whose current work is funded by Verily Life Sciences LLC (an Alphabet company and Google affiliate).

Dr Staunton and colleagues in the AITHM public health entomology research group are working with JCU's Internet of Things team to develop a simple, low-cost sound trap powered by AA batteries. This would be a practical alternative to current models reliant on mains power or 12-volt batteries. Such a trap would be particularly useful in developing countries or during large scale "rear and release" programs, where funding for surveillance is limited.

# OUR PEOPLE





ATHM supports hundreds of talented researchers, professional members, staff members and technical employees. Our staff and members are sharing their skills and knowledge in the community, the media and in schools, promoting and educating people about their research and about scientific endeavours more generally.



## GRANTS, FELLOWSHIPS AND AWARDS

### NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL'S FRANK FENNER AWARD

AITHM's Dr Matt Field received the NHMRC Frank Fenner Award, which recognises the year's top NHMRC Early Career Fellowship application Biomedical or Public Health Early Career Fellowship Category. The Award is named after the Australian scientist whose groundbreaking research led to the eradication of smallpox. At AITHM, Dr Field specialises in developing high-throughput bioinformatics analyses, and collaborates with researchers who are tackling some of the great health challenges in the Tropics, including malaria, dengue fever, tuberculosis and parasitic worms, as well as chronic diseases and cancers with high incidence in the region.



*Dr Matt Field with  
NHMRC CEO  
Anne Kelso*

## MAJOR GRANTS AND FELLOWSHIPS COMMENCING IN 2018

- Professor Denise Doolan and Professor Alex Loukas each received \$2.2M from a NHMRC Collaborations Grant with colleagues from QIMR, Menzies Research Institute, Griffith University and Menzies School of Health, for the project 'Tropical Diseases Program: Translating discoveries into better health'.
- Professor Sarah Larkins and JCU colleagues Dr Judy Taylor, Professor Yvonne Cadet-James, Associate Professor Catrina Felton-Bush, Associate Professor Emily Callander and Dr Rebecca Evans received a NHMRC Project Grant of \$1.79M for the project 'Women's Action for Mums and Bubs (WOMB): A pragmatic trial of participatory women's groups to improve Indigenous maternal and child health'.
- Professor Sarah Larkins and JCU colleagues Associate Professor Catrina Felton-Busch, Professor Emma McBryde, Dr Rebecca Evans and Dr Karen Carlisle received a NHMRC Partnerships Grant of \$1.14M for the project 'Implementation of quality improvement in Indigenous primary health care: Leveraging Effective Ambulatory Practices (LEAP)'.
- Associate Professor Sophie Couzos, Emeritus Professor Rhondda Jones, Associate Professor Emily Callander, Dr Erik Biros, Dr Deb Smith, Ms Michelle Bellingan, Professor Beverly Glass, Ms Priscilla Page, Mr Donald Whaleboat, Dr Robyn Preston and Ms Nicole Bates received \$1.04M from the Department of Health for the project 'Integrated Practice Pharmacists within Aboriginal Community Controlled Health Services'.
- Professor Denise Doolan received a NHMRC Principal Research Fellowship of \$0.85M to support her research on system-based approaches to inform the design of vaccines and biologics against complex pathogens.
- Professor Alex Loukas, together with team members Dr Michael Smout and Dr Javier Sotillo-Gallego, received \$0.83M from the National Institute of Health for research into carcinogenic liver fluke infection: gene editing and vaccination-mediated approaches to interrupt host-parasite communication.
- Professor Emma McBryde received \$0.48M from The Global Fund to Fight AIDS, Tuberculosis and Malaria for research on national TB control models.
- Dr Andreas Kupz received a NHMRC Career Development Fellowship of \$0.44M to support research on new strategies for improved TB vaccines.
- Dr Stephan Karl received a NHMRC Career Development Fellowship of \$0.33M for research on *plasmodium vivax* transmission blocking studies in the South Pacific.
- Dr Matt Field received a NHMRC Early Career Fellowship of \$0.33M to support the development of core bioinformatics capacity at AITHM.
- Professor Alex Loukas and colleagues Associate Professor John Miles, Dr Paul Giacomini and Professor Norelle Daly received funding from Paragen Bio Pty Ltd to develop drugs for the treatment of autoimmune disorders.
- Professor Scott Ritchie and JCU colleague Professor Wei Xiang received funding from Verily Life Sciences to design and validate low cost smart mosquito traps for *Aedes aegypti* and *Aedes albopictus* mosquitoes to be used to inform modern "rear and release" programs that use *Wolbachia* infected mosquitoes to naturally suppress populations of these dengue vectors.

## SHARING OUR RESEARCH

Researchers at AITHM shared their discoveries and insights extensively through social media, television, podcasts, traditional and online media in 2018. Our experts provided commentary and opinion to national and international journalists when big news breaks occurred in their field. AITHM researchers have been called upon to discuss health, disease, economics, mosquitoes, bioinformatics and jellyfish.

Toxinology expert Associate Professor Jamie Seymour was featured in more than 270 stories across multiple media platforms when irukandji jellyfish were captured further south than their usual habitat.

Research Fellow Dr Kyran Staunton from the Tropical Medical Mosquito Research Facility was quoted in 130 media articles when he shared information about his work around the transmission of dengue, Zika and yellow fever.

The AITHM communications team and JCU media team shared 29 stories, including 15 media releases, about AITHM people and their work in 2018, generating 1130 commentaries across print, television, radio and online platforms.

## SPIRITED DISCUSSIONS

AITHM researchers took their science to the people and to the pub in 2018. In Cairns and Townsville, AITHM scientists spoke at sold-out events at breweries and pubs during the Pint of Science festival in May. The volunteer-run festival sees experts explain the science behind their work, careers, and behind every day phenomena in a relaxed setting. AITHM's Pint of Science Cairns presenters in 2018 included Associate Professor Jamie Seymour, who spoke about venom, and Professor Scott Ritchie, who delivered a talk titled 'Debugging Dengue.' In Townsville, Dr Joe Moxon spoke about peripheral artery disease, Dr Aya Takai about allergy, and Professor Zoltan Sarnyai about schizophrenia. AITHM researchers also supported JCU's 'Inspiration on Tap' public lecture series in 2018.

## AITHM AT TEDx CAIRNS

The 2018 line-up for the annual TEDx event run by JCU's The Cairns Institute included two AITHM researchers. AITHM researcher Dr Sandip Kamath spoke about his work in the field of food allergy and Dr Alexandra Trollope presented insights into epigenetics when she spoke about stress-related learning and memory, stroke and peripheral vascular disease (PVD).

## AN EVENTFUL WEEK OF SCIENCE

National Science Week in August was a busy time for AITHM researchers. In Cairns, Dr Ashley Waardenberg went back to school to teach children about DNA with a Lego-inspired game. The children from St Francis Xavier school translated their names into DNA code, using the A, T, C, G letters (the Lego pieces) in the tri-nucleotide format.

AITHM colleagues, Associate Professor Jamie Seymour and Dr Andreas Kupz got behind the microphone at ABC North Queensland to talk about their research during Science Week programming.

Dr Kate Miller and Dr David Wilson spoke about biomedicine venomous creatures during PechaKucha at The Tanks in Cairns.

AITHM researchers associated with the Australian Brain Alliance, Dr Smriti Murali Krishna, Dr Alex Trollope, Nicole Thomas and Dr Hayley Letson, shared their research at a National Science Week showcase that attracted a wide and diverse audience. "A highlight of the showcase was the fact that brain research was a key area and the wider community, young high school students as well as older community members, found the topic equally engaging," said Dr Krishna.

Neuroscientist, Professor Zoltan Sarnyai delivered a presentation on stress and resilience at a special event during Science Week, Brain and Biome, in Brisbane.

AITHM was also involved in an inaugural Science, Technology, Engineering and Mathematics (STEM) day for school children, attended by 120 local children, and in the JCU Open Days on the Cairns and Townsville campuses, which drew big crowds.





## MEMBERS' CORNER

Since 2013, AITHM has grown to a membership of more than 280. Members are a diverse group of clinicians, industry professionals, researchers, scientists and future tropical health researchers who are interested in understanding and collaborating in tropical health and medicine. Membership has opened up their capacity to reach a communication network of over 1000 people across Queensland and beyond for events, funding opportunities, training and research support.

### HOW REDUCING POULTRY DISEASE IS IMPROVING THE QUALITY OF LIFE OF RURAL ZAMBIAN COMMUNITIES

An innovative poultry disease surveillance program supported by JCU AITHM member Professor Bruce Gummow and a Zambian veterinary team is improving food security and income generation for the country's farming communities.

Project lead, Professor Gummow, explains the link between healthy chickens and healthy human communities in Zambia.

Chickens are a practical source of food for low-income families and, in Zambia, chickens can also act as currency. When families need to pay school fees or buy textbooks for their children, they sell chickens to fund their purchases.

"The poultry diseases that spread through these communities can be likened to the medieval plagues, and failure to respond rapidly has had devastating consequences for the livelihood of these communities," said Professor Gummow, who has worked on projects in Zambia since 2014.

The team works with poultry farmers – many of whom are single or widowed women – and looks at how they interact socially to identify hubs where poultry disease is most likely to be transmitted.

Farmers are encouraged to establish local poultry clubs in these hubs to chat about chicken problems in their villages and collate data on the health of their poultry,

which is passed onto veterinary services to aid early disease detection and response.

The initiative has resulted in such a dramatic drop in poultry mortality in the villages that local communities are now setting up markets to sell the excess chickens, leading to increased food security and income generation.

The Zambian Ministry of Fisheries and Livestock says more than 90 per cent of rural poultry farmers have found the initiative to be very useful and many of the poultry clubs are now expanding into co-ops that are using their profits to purchase vaccines in bulk.

"The knock-on effect is the villagers have an improved standard of living and protein source, which translates into healthier people."

"The work is unique because it's community-driven and requires minimal infrastructure and resources. This is what makes it sustainable and different from other attempts to solve this problem."

## REDUCING MEDICAL EVACUATIONS OF PREGNANT WOMEN FROM FAR NORTH QUEENSLAND COMMUNITIES

Something as small and simple as a coffee catch-up can lead to big things when the people who meet are a pair of curious and motivated researchers and clinicians, according to AITHM member Sandra Downing.

In 2018, Ms Downing, a JCU public health and tropical medicine senior lecturer led a collaborative research project with Cairns and Hinterland Hospital and Health Service (CHHHS) and the Royal Flying Doctors Service (RFDS). That project is expected to lead to a reduction in medical evacuations of pregnant women from Torres and Cape York communities, saving money and heartache.

"The story starts like this," explains Ms Downing, "a clinician and a researcher meet in a coffee shop..."

The clinician to whom Ms Downing refers, RFDS Dr Tonya Marquardt, said she suspected women were being transferred unnecessarily for threatened pre-term labour. As a nurse-midwife, now academic researcher, Ms Downing decided to 'phone a friend', as she describes it, at Cairns Hospital and begin a study. The hard-fought result was one of the first research collaborations between RFDS, Cairns Hospital and JCU.

Threatened pre-term labour is one of the most common reasons for obstetric transfer in rural and remote communities. The purpose of Ms Downing's study was

to determine the role a bedside clinical test – fetal fibronectin testing - could play in reducing these medical evacuations.

The research team used a chart review to gather their data. They found that, in the five-year study period, 30 of the 47 evacuations for threatened preterm labour of women from Cape communities might have been avoided if the simple testing procedure was performed routinely at the first opportunity.

The team calculated potential savings greater than \$200,000, taking into account the costs of medical evacuation and the inpatient nights (41) and outpatient nights (443).

"What you also need to consider are the social and emotional costs to women and families who are possibly going through a traumatic experience – medical evacuation - at a time when they would prefer to be among family and friends in their own communities," said Ms Downing.

The results were shared among all research partners, and with the Torres and Cape Hospital and Health Service, which is now providing ongoing education to clinicians in their communities about fetal fibronectin testing, and facilitating its consistent use.





## SUPPORTING RESEARCHERS FOR THE FUTURE

AITHM's Cohort Doctoral Studies Program assists and nurtures Higher Degree by Research (HDR) students using a unique and highly successful cohort model. The cohort program provides doctoral students with academic mentors, writing workshops and seminars, a peer support network, and two one-week on-campus intensive research-training courses each year. The program was established in 2011 with the aim of supporting health professionals who are working full or part time to further their research goals. Students learn about and conduct research in areas of medicine and health, including health promotion, nursing, rehabilitation, and sports and exercise sciences. The program also includes students working in the fields of chemical, biomedical, molecular and veterinary sciences.

In 2018, there were 122 students enrolled in the program across 15 cohorts and, to date, there have been 29 HDR students from the Cohort Doctoral Studies Program who have completed their degrees. Retention in the program is high at 88 per cent, and student outputs total more than 251 peer-reviewed publications since the commencement of the Cohort Program.

The innovative approach and hard work of the Cohort Doctoral Studies Program was recognised by JCU in 2018 with a JCU Learning and Teaching citation. Dr Melissa Crowe and the Cohort Doctoral Studies program team were cited for 'Providing outstanding leadership in research education including professional development opportunities, collegial networking and mentoring, promoting scholarship and research outcomes within a supportive environment.'

In 2018, AITHM also initiated the establishment of an Early and Mid-Career Researcher (EMCR) Professional Development Working Group to provide dedicated support and resources to developing health researchers at JCU. Early initiatives launched include a regular EMCR seminar series, a structured grant-writing support process, an annual networking retreat and the development of targeted mentoring arrangements with senior research leaders.



*Dr Zulfiqar Otty and  
Dr Sabe Sabesan*

## IMPROVING CANCER CARE PATHWAYS FROM DIAGNOSIS TO SURVIVORSHIP: A COHORT DOCTORAL STUDIES PROGRAM STORY

**T**welve years ago, Townsville oncologist and AITHM-affiliated researcher Professor Sabe Sabesan began his own PhD. Now he is supervising two of his colleagues at Icon Cancer Care as they use their research studies to improve patient experiences and outcomes, and streamline cancer services 'from diagnosis to survivorship'.

Professor Sabesan was in Cohort 1 of the JCU AITHM Cohort Doctoral Studies program. His colleagues, also oncologists, Dr Zulfiqar Otty and Dr Abhishek Joshi, are part of cohort 12. Both Dr Joshi and Dr Otty want to use their research to improve the delivery of cancer care in Townsville and to improve outcomes for their patients, but they are tackling the issues from different angles and fields of expertise. Dr Joshi's study will focus on the care and treatment of breast cancer patients, and Dr Otty will look at lung cancer care.

Dr Joshi said cancer care had traditionally been looked at from a health service perspective; it is a very clinically-driven, hospital and health provider focused model. "One needs to look from the patient perspective to identify gaps. People can see so many specialists and health professionals following a cancer diagnosis. How do they navigate from GP to specialist?" said Dr Joshi. "The one cohort of patients with very similar conditions can have very different experiences of the system, and there are delays in cases that can affect patient outcomes. I want to streamline the process from diagnosis

to survivorship." Dr Joshi explains that with no overarching governance for the process, inefficiencies and poorer outcomes for patients were more likely. He is looking into the feasibility, governance, patient-centred outcomes and economics of his proposed pathway for breast cancer patients.

Dr Otty specialises in lung cancer treatment and wants to develop and implement a streamlined pathway that describes the optimal processes, timeframes and delivery methods for managing lung cancer. "Patients, including those suffering from cancer, in rural and remote areas have worse health outcomes. They have delays in diagnosis and treatment," said Dr Otty. "There have been significant advances in management of advanced lung cancer in the recent years. Successfully translating these advances into improved patient outcomes requires timely diagnosis and treatment, as well as incorporating novel technologies." Dr Otty will consider the perspectives of treating clinicians' to identify gaps, opportunities, and the feasibility of incorporating telemedicine.

# OUR FACILITIES AND CENTRES







AITHM and JCU have health and medicine facilities and research centres across Queensland in Cairns, Townsville, Mackay, Mount Isa and the Torres Strait. In 2018, AITHM held opening ceremonies on Thursday Island and in Cairns for its newest laboratory and community facilities.

## OPENING UP NEW OPPORTUNITIES

Years of planning, construction and certification came together in 2018 when official opening ceremonies were held for AIITHM's newest research facilities in Cairns and on Thursday Island in the Torres Strait. These two new facilities added to the existing AIITHM facilities in Townsville, Cairns and Mackay.

### Cairns

AIITHM's newest building on the Cairns campus of JCU was officially opened by the Minister for Resources and Northern Australia, Senator the Honourable Matthew Canavan in April. The Australian Government provided \$18M for the building via the Australian Research Council's Special Research Initiative Scheme and the Queensland Government contributed a further \$6.5M.

The building features expanded laboratory space, including an additional PC2 laboratory and a secure facility designed for certification as Quarantine Containment Level 2 (QC2) for the safe study of mosquitoes that can spread tropical diseases. It also contains cryogenic facilities capable of storing clinical bio-bank material and research samples at temperatures as low as  $-190^{\circ}\text{C}$ . The new cryogenic freezers will support research on materials from Queensland's rainforests and coral reefs, such as venoms, toxins and microbes that either threaten health in the Tropics or have potential therapeutic applications.

### Thursday Island

Queensland Minister for Training and Skills Development, The Honourable Shannon Fentiman, officially opened the new AIITHM facility on Thursday Island in November 2018. The building, adjacent to the Thursday Island Hospital, was funded by the Queensland Government (\$6.3M) and James Cook University (\$0.3M).

The Thursday Island facility was designed to support community engagement, research and training. The colourful building houses the Torres Strait's first specialist PC2 laboratory and includes teaching, clinical, meeting and video conference facilities as well as visitor accommodation. At the facility, AIITHM researchers work on issues of relevance to the Torres Strait, including infectious diseases such as tuberculosis, chronic diseases such as diabetes and obesity, and controlling the spread of mosquitoes that transmit diseases like dengue and Zika. Community groups, visiting education and training providers, researchers and students undertaking fieldwork and clinical placements also use the facilities. The Torres Strait Regional Authority is one of the many community stakeholders regularly using the facilities for meetings and conferences.

The AIITHM Thursday Island facility won the Eddie Oribin Award for Building of the Year, 2019 Queensland Architecture Awards.



*Cairns' newest AIITHM facilities unveiled*



*Community members participate in the opening ceremony for AIITHM's facilities on Thursday Island*

# JCU RESEARCH CENTRES

AITHM works closely with colleagues from JCU's established health research centres including those mentioned below.

## Anton Breinl Research Centre for Health Systems Strengthening

**Director: Professor Sarah Larkins**

The Centre brings together a multidisciplinary team of medical, nursing, public health and allied health researchers to build on JCU's strong record of rural, remote, Indigenous and tropical health research. Its research focus is on meeting the priority health needs of Northern Australia and our near tropical neighbours through research that makes a difference, and training a workforce with the knowledge, skills and attitudes to respond to priority health needs. The Centre aims to progress health equity in partnership with Aboriginal peoples and Torres Strait Islanders, rural and remote populations, tropical populations in neighbouring countries and other underserved groups.

<https://research.jcu.edu.au/abrc>

## Queensland Research Centre for Peripheral Vascular Disease

**Director: Distinguished Professor Jonathan Golledge**

This Centre focusses on research designed to improve understanding and ultimately improve management of peripheral vascular diseases. Current research undertaken in the Centre includes: pre-clinical work designed to identify treatment targets and risk predictors for

peripheral vascular disease patients; studies aimed at better understanding mechanisms involved in peripheral vascular disease development and progression, and clinical studies and trials designed to identify or test therapies for peripheral vascular disease.

<https://www.jcu.edu.au/qrcpvd>

## Centre for Chronic Disease Prevention

**Director: Professor Robyn McDermott**

The Centre's aims are to work with service providers, community organisations and academic partners to improve prevention and primary care management of chronic conditions common in Northern Queensland, mainly obesity, diabetes, cardiovascular and renal disease, especially in high-risk populations. The team works with large linked population datasets to better understand causal pathways, including nutritional determinants of risk, the reasons for excessive hospital admissions for preventable chronic conditions, the promotion of evidence-based primary care in chronic care, and identifying key points for intervention to improve health outcome in susceptible people.

## Centre for Molecular Therapeutics

**Director: Professor Denise Doolan**

The Centre supports innovative cross-disciplinary research projects using state-of-the-art technologies to discover and develop novel therapeutics and diagnos-

tics from the Tropics and for the Tropics. The enormous biodiversity of North Queensland provides a unique opportunity to explore and test new medicines derived from parasites and other microorganisms. Using these natural resources, we aim to develop novel therapeutics for a range of infectious diseases and non-infectious human illnesses, including chronic disorders, allergies and autoimmune diseases as well as envenomation. The Centre (previously called the Centre for Biodiscovery and Molecular Development of Therapeutics) aims to translate discoveries in the Tropics to commercial activities that reach the global market.

<https://www.jcu.edu.au/cmt>

## Centre for Rural and Remote Health

**Director: Professor Sabina Knight**

JCU's Centre for Rural and Remote Health, headquartered in Mount Isa, has a mission of leading excellence in remote, rural and Indigenous health research. The group undertakes and contributes to research relevant to health workforce and health in outback Queensland. Key research areas include rural health workforce development, rural health improvement, rural health services improvement, and innovation: developing new models of care to achieve better health outcomes.

<https://www.crrh.jcu.edu.au/>



# OUR GOVERNANCE AND FINANCE



## Advisory Board

The AITHM Advisory Board oversees the progress of AITHM and advises the Institute on ways that it might develop its research agenda. The Advisory Board provides independent and strategic advice on all aspects of the Institute, including high-level business management, research and commercialisation, and linkages with government, industry and philanthropic institutes.

The Board comprises members from a diverse range of external organisations as well as senior staff from JCU. It meets three times a year.

- **The Hon. Dr Michael Wooldridge**  
*Independent Chair*  
Wooldridge Consulting
- **Ms Clare Douglas**  
*(delegated to Ms Nicki Murdoch)*  
*Chief Executive*  
Cairns and Hinterland Hospital and Health Service
- **Professor Denise Doolan**  
*Deputy Director*  
AITHM
- **Professor Louis Schofield**  
*Director*  
AITHM
- **Professor Chris Cocklin**  
*Senior Deputy Vice Chancellor*  
JCU

- **The Hon. Jan McLucas**  
*Independent*
- **Ms Lea Diffey**  
*Executive Director*  
Department of Science, Information Technology and Innovation, Queensland Government
- **Professor Zee Upton**  
*Research Director*  
Institute of Medical Biology Agency for Science, Technology and Research
- **Mr Tony Wood**  
*Program Director*  
The Grattan Institute
- **Mr Kieran Keyes**  
*Chief Executive*  
Townsville Hospital and Health Service
- **Professor Ian Wronski**  
*Deputy Vice Chancellor*  
JCU

## Management Advisory Committee

The Management Advisory Committee provides advice to AITHM management regarding key issues pertaining to AITHM's activities, its operations, management and research program direction. The Committee is comprised of senior staff from the DTHM and AITHM: the DTHM Deputy Vice Chancellor, College Deans and Director, Research Development and the AITHM Director, Deputy Director and Head of Operations.

# FINANCIAL STATEMENT

The following general information is extracted from the 2018 Annual Report for James Cook University, published 2019<sup>1</sup>. The principal accounting policies adopted in the preparation of these financial statements reflect the accounting policies used in the audited financial statement for James Cook University for the year ended 31 December 2018. The accounts are prepared on an accrual basis and comply with Australian Accounting Standards. It also requires management to exercise its judgement in the process of applying the University's accounting policies. The estimates and underlying assumptions are reviewed on an ongoing basis.

## Audit Committee

The Audit Committee is responsible for all audit and related matters, and for monitoring the assigned performance measures on behalf of James Cook University (JCU) Council — thereby assisting the University to fulfil its responsibilities under the Financial Accountability Act 2009. The Act requires the mandatory appointment of the Auditor-General of Queensland as the University's external auditor. The Audit Committee also reviews the Queensland Audit Office's (QAO) approved audit strategy, observes the terms of the committee charter, and has due regard to QLD Treasury's Audit Committee Guidelines.

## Internal Audit

Internal Audit is an independent, objective assurance and consulting activity designed to add value and improve the University's operations. It assists the University accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes. Internal Audit activity encompasses the review of all financial and non-financial policies and operations of the University, excluding controlled entities.

## Statement of Operating Income and Expenses for the year ended 31 December 2018

Notes	INCOME	2017 \$	2018 \$
	State Government Funding (DSITI)	400,000	-
	Host Institution Funding (James Cook University)	4,038,891	5,441,860
	External Research Grants & Consultancies	6,587,189	6,467,375
	Other Income	785,859	794,312
	<b>Total Income</b>	<b>11,811,938</b>	<b>12,703,548</b>

Notes	EXPENDITURE	2017 \$	2018 \$
	Operational		
	Salaries	6,000,398	6,038,499
	Equipment & Maintenance	1,233,746	1,485,556
	Other Expenditure	1,570,281	1,354,694
	Capacity Building Grants (DSITI)		
	Salaries	410,603	230,853
	Equipment & Maintenance	19,570	19,538
	Other Expenditure	513,121	303,502
	External Research Grants		
	Salaries	3,078,662	4,214,544
	Equipment & Maintenance	108,012	105,843
	Other Expenditure	2,603,667	3,410,861
	<b>Total Expenditure</b>	<b>15,538,060</b>	<b>17,163,891</b>
<b>1</b>	<b>Surplus/(Deficit)</b>	<b>(3,726,122)</b>	<b>(4,460,343)</b>

Notes	INCOME	2017 \$	2018 \$
	Balance Brought Forward	19,367,148	15,641,027
<b>1</b>	<b>Surplus/(Deficit)</b>	<b>(3,726,122)</b>	<b>(4,460,343)</b>
	<b>Closing Balance</b>	<b>15,641,027</b>	<b>11,180,684</b>


<sup>1</sup> James Cook University Annual Report 2018, ISSN 0158-7730. Produced by, and available from Quality, Planning and Analytics, James Cook University. This Annual Report is also publicly available on the JCU website at <https://www.jcu.edu.au/about-jcu/annual-report>.

# ACRONYMS

<b>AIDS</b>	Acquired Immune Deficiency Syndrome	<b>NHMRC</b>	National Health and Medical Research Council	<b>TASRU</b>	Tropical Australian Stinger Research Unit
<b>AITHM</b>	Australian Institute of Tropical Health and Medicine	<b>NMR</b>	Nuclear magnetic resonance	<b>TB</b>	Tuberculosis
<b>APEDNN</b>	Asia Pacific Emergency Disaster Nurses Network	<b>NT</b>	Northern Territory	<b>TBI</b>	Traumatic Brain Injury
<b>ARC</b>	Australian Research Council	<b>NTM</b>	Non-Tuberculosis Mycobacteria	<b>THHS</b>	Townsville Hospital and Health Service
<b>CHHHS</b>	Cairns and Hinterland Hospital and Health Service	<b>NPA</b>	Northern Peninsula Area	<b>TMMRF</b>	Tropical Medicine Mosquito Research Facility
<b>CIRH</b>	Centre for Innovation in Regional Health	<b>OGTR</b>	Officer of the Gene Technology Regulator	<b>TOF</b>	Time-of-flight
<b>DFAT</b>	Department of Foreign Affairs and Trade	<b>PAD</b>	Peripheral Artery Disease	<b>TRF</b>	Translational Research Facility
<b>DSITI</b>	Department of Science Information, Technology and Innovation	<b>PC2</b>	Physical Containment level 2	<b>UDRH</b>	University Department of Rural Health
<b>DTHM</b>	Division of Tropical Health and Medicine	<b>PC3</b>	Physical Containment level 3	<b>UQ</b>	University of Queensland
<b>EMCR</b>	Early and Mid-Career Researcher	<b>PhD</b>	Doctor of Philosophy	<b>USA</b>	United States of America
<b>ECR</b>	Early Career Researcher	<b>PHN</b>	Primary Health Network	<b>WHO</b>	World Health Organisation
<b>FNQ</b>	Far North Queensland	<b>PNG</b>	Papua New Guinea	<b>WHOCC</b>	World Health Organisation Collaborating Centre
<b>GM</b>	Genetically modified	<b>PNG IMR</b>	Papua New Guinea Institute of Medical Research	<b>WOMB</b>	Women's Action for Mums and Bubs
<b>HDR</b>	Higher Degree by Research	<b>PVD</b>	Peripheral Vascular Disease		
<b>HIV</b>	Human Immunodeficiency Virus	<b>QReCS</b>	Queensland Remote Chemotherapy Supervision		
<b>iccdr,b</b>	International Center for Diarrhoeal Disease Research, Bangladesh	<b>RFDS</b>	Royal Flying Doctors Service		
<b>ILO</b>	Indigenous Liaison Officer	<b>RNA</b>	Ribonucleic Acid		
<b>JCU</b>	James Cook University	<b>SARS</b>	Severe Acute Respiratory Syndrome		
<b>LEAP</b>	Leveraging Effective Ambulatory Practices	<b>SORT-IT</b>	Structured Operational Research and Training Initiative		
<b>MALDI</b>	Matrix-assisted laser desorption ionization	<b>SRI</b>	Special Research Initiative		
<b>MRFF</b>	Medical Research Futures Fund	<b>STEM</b>	Science, Technology, Engineering and Mathematics		
<b>MS</b>	Mass Spectrometer	<b>TAAHC</b>	Tropical Australian Academic Health Centre		







AITHM believes that the people of Northern Australia and the Tropics deserve innovative health solutions and systems tailored to the distinctive health care issues they face. The solutions we find to address the issues in tropical Australia have a broader application that will benefit other populations.