



# Annual Report 2021

## Australian Institute of Tropical Health and Medicine



AIITHM | AUSTRALIAN INSTITUTE  
OF TROPICAL HEALTH & MEDICINE







**Acknowledgements**

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

We acknowledge the Australian Aboriginal and Torres Strait Islander peoples as the Traditional Owners of the lands and waters where we operate our business. We honour the unique cultural and spiritual relationship to the land, waters and seas of First Australian peoples and their continuing and rich contribution to the AITHM, JCU and Australian society. We also pay our respects to ancestors and Elders past, present and future.

**WARNING:** Aboriginal and Torres Strait Islander readers are advised that this report may contain images and names of deceased persons.



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*Townsville City from Castle Hill*

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***"Building on our strategic location in North Queensland, we have continued to deliver research excellence and improved health outcomes, contributing to a network of skilled professionals across national and international health sciences and biotech industries."***



## Message From the Director

Welcome to the Australian Institute of Tropical Health and Medicine (AITHM) 2021 Annual Report, showcasing some of the year's activities, engagements, strategic initiatives, and achievements delivering world-class health and medical research outcomes.

In reflecting on the past 12 months, it is apparent AITHM is now an established hub of translational research excellence, spanning the complete pipeline from discovery to clinical translation and impact.

Building on our strategic location in North Queensland, we have continued to deliver research excellence and improved health outcomes, contributing to a network of skilled professionals across national and international health sciences and biotech industries. To support this, our researchers have been successful in securing a number of highly competitive grants in 2021 from national and international funding agencies, across our diverse research portfolio.

The global COVID-19 pandemic has highlighted the importance of health and medical research, and collaboration – regionally, nationally and internationally. The Institute strengthened its position in 2021, as a key partner of the Queensland Biomedical Research Alliance, which aims to build the State's reputation and capacity in key areas of research.

A focus in 2021 has been on infectious diseases, under the banner of the Queensland Alliance for the Control of Infectious Diseases (QACID). Our researchers have continued to be a driving force behind national health policy, contributing their expertise in areas related to infectious diseases, including COVID-19, and their impact on individuals and communities throughout the world.

We have also seen important advances towards innovation and research partnerships to further support industry development and economic diversification. In support of this, AITHM has continued to develop internationally competitive strengths in several areas

suitable for commercialisation which have the potential to seed regional biotechnology development in North Queensland. These include new vaccines, drugs, and therapeutics and diagnostic platforms. Expansion of these and other development efforts will continue in 2022.

Another focus in 2021 has been increased engagement with government, industry, stakeholders, and the community. A particular highlight was a breakfast event with the Queensland State Parliament in October, with senior and key departmental officials, industry and collaborating partners, hosted by the Honourable Curtis Pitt MP, Speaker of the Legislative Assembly of Queensland and Member for Mulgrave. This resulted in an increased awareness among the State's decision makers of the work being undertaken in North Queensland. AITHM has subsequently hosted several high-profile visits in Townsville and Cairns. We have also continued our extensive engagement with the Asia Pacific, recognising the importance of our valuable partners and continuing to serve those populations with the most need.

In closing, I would like to extend my sincere gratitude to the staff, students and partners who make up AITHM for their dedicated efforts and support. You make everything possible!

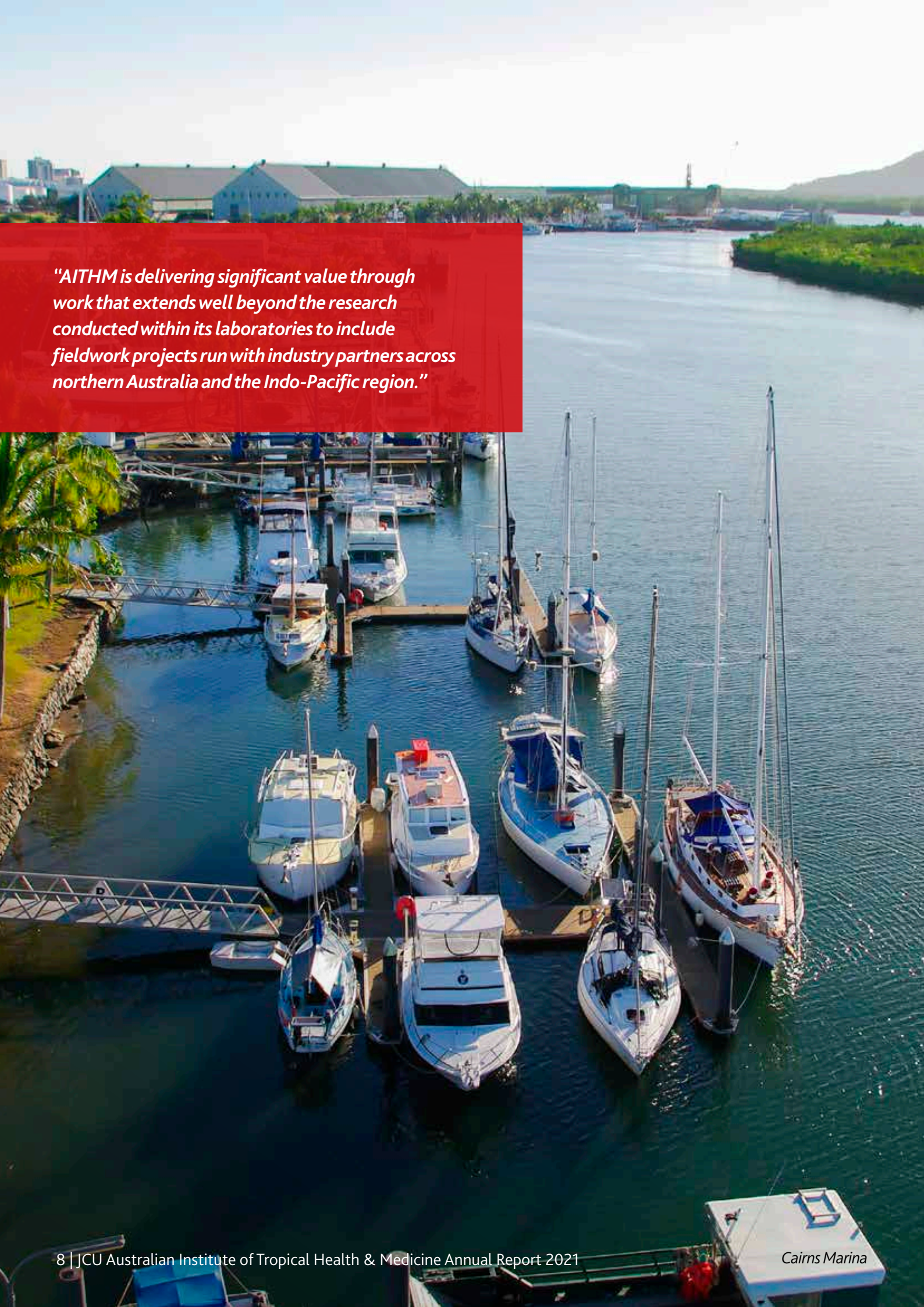
**Professor Denise Doolan,**  
**Acting Director, Australian Institute of Tropical Health and Medicine**



# Where We Work







*"AITHM is delivering significant value through work that extends well beyond the research conducted within its laboratories to include fieldwork projects run with industry partners across northern Australia and the Indo-Pacific region."*



## Message From the Chairman

### *Transitioning tropical health research into a new era*

This year has been a challenging but exciting period for the Australian Institute of Tropical Health and Medicine (AITHM), as it comes to the end of its original establishment funding, and begins the transition into a new era.

Almost a decade ago, AITHM was backed by both the Queensland State and Federal Governments, who recognised the importance of improving Australia's capacity and effectiveness in tropical health and medical research, training, and translation in Northern Australia. A commitment of \$84 million saw modern research facilities established, on James Cook University (JCU) campuses in Townsville and Cairns, and expanding to Mackay and Thursday Island.

In addition to establishing outstanding research infrastructure, AITHM used the government investment to support the recruitment of world class researchers, whose focus on tropical health and medicine has further strengthened the capacity of Australia's medical research institutes.

AITHM is delivering significant value through work that extends well beyond the research conducted within its laboratories to include fieldwork projects run with industry partners across Northern Australia and the Indo-Pacific region that are delivering genuine impact to health industries and communities, the development of research capacity within health sector professions, and contributions to economic development and diversification in regional North Queensland.

AITHM is engaged with health service, industry and education partners, in the development of two important new regional health and knowledge precincts: Townsville's Tropical Intelligence and Health Precinct (TropiQ) and the Cairns Health and Innovation Precinct, which will see the construction of new facilities that bring together Cairns Hospital and JCU, supporting collaboration and innovation in health education and research.

I would like to thank AITHM Director Distinguished Professor Louis Schofield, and Acting Director Professor Denise Doolan for their leadership, and the academic and research staff and all support staff who have put in a great effort through a challenging period.

**Dr Michael Wooldridge**  
**Chairman, Australian Institute of Tropical Health and Medicine**  
**Advisory Board**





# Research and Development

The Australian Institute of Tropical Health and Medicine (AITHM) is Australia's leading health research institute based in the Tropics, for the Tropics. The Institute's work is centred around three key research themes:

- Diseases of High Burden in the Tropics;
- Tropical Health Security; and
- Tropical Health Systems

## Diseases of High Burden in the Tropics

Research in this area focuses on improving prevention, treatment and diagnosis of infectious and chronic diseases of relevance to the Tropics. It includes the development of new molecular therapeutics and diagnostics resulting from studies in immunology, host-pathogen interactions, and epidemiology. Our vaccine development program includes vaccines for malaria, parasitic worms (helminths) and tuberculosis (TB). Our researchers are also developing ways to exploit the potential benefits of tropical flora/fauna, including properties from parasites/helminths and toxins, to create new therapeutics. Work in this area includes:

- Tropical diseases and parasites such as:
  - Tuberculosis
  - Dengue
  - Malaria
  - Helminths
  - Newly emerging pathogens.
- Chronic non-communicable diseases which are prevalent in tropical populations, including:
  - Diabetes
  - Respiratory inflammation/allergy
  - Inflammatory bowel disease
  - Cardiovascular disease
  - Wounds and healing
  - Mental illness
  - Age-related diseases.

## Tropical Health Security

Research in this sphere focuses on promoting and supporting Australia's human and animal biosecurity, food security, and addressing the risk of disease spread across borders throughout tropical regions. Work in this area includes:

- Vector (mosquito and tick-borne disease) control
- Disease surveillance, monitoring, containment, and prevention to protect communities against potential disease outbreak
- One Health (the intersection between human and animal health and their environments)
- Zoonoses (disease that spread between animals and people) including disease pathology and epidemiology
- Animal/veterinary health, biodiversity and conservation (including animal nutrition, reproduction, disease risk, behaviour and wildlife conservation)
- Animal production/food security
- Preparedness and health and humanitarian response to disasters
- Collaborations with defence.

## Tropical Health Systems

Research under this theme focuses on strengthening and building health workforce and health systems, particularly in rural, remote and Aboriginal and Torres Strait Islander communities. Work in this area includes:

- Health workforce development
- Development, implementation and evaluation of new models of healthcare delivery
- Strengthening health system responses to improve the health of Aboriginal and Torres Strait Islander peoples
- Working with clinical partners to translate research findings into healthcare improvements
- Capacity building within underserved healthcare systems
- Development, deployment and adoption of health technologies including telehealth

# Our Impact

## *Dengue elimination trials covering more ground*

It has been over two years since researchers from Monash University, JCU's AITHM and colleagues reported the remarkable outcome of successfully suppressing populations of the dengue vector mosquito *Aedes aegypti* in the Cairns and Townsville regions – effectively declaring those regions dengue-free.

This outcome was the result of a collaboration between AITHM, The University of Queensland, QIMR Berghofer Medical Research Institute and Monash University, working under the banner of the Eliminate Dengue Program, which saw sterilised mosquitoes bred through AITHM's Tropical Medicine Mosquito Research Facility (TMMRF) and released into the community from 2011.

The novel biological control method established in that original work involved sterilising and releasing both male and female *A. aegypti* mosquitoes by infecting them with a strain of the *Wolbachia* bacteria.

The *Wolbachia bacterium* acts like a vaccine against dengue. It effectively blocks the mosquito from becoming infected and in doing so, stops their capability to transmit the disease to humans.

More recently the AITHM team, in collaboration with CSIRO, QIMR Berghofer Medical Research Institute (Brisbane) and 'Verily Life Sciences Debug Project (USA) have been testing this innovative dengue control method in three additional small communities located in the Innisfail area of North Queensland, with promising outcomes to date.

In a change to the original methodology used in the Eliminate Dengue Program, this latest project focussed on the release of male mosquitoes only.

Three million *Wolbachia*-infected *A. aegypti* mosquitoes were bred, with the male mosquitoes then being released three times a week at the Innisfail test sites over a 20-week period in 2017-2018. The mosquitoes were released from specially-designed vans that used GIS technology to track the number of mosquitoes released and the locations of release.

"When *Wolbachia*-infected male mosquitoes breed with wild female *A. aegypti* mosquitoes, the females lay eggs that either do not hatch, or the *Wolbachia*-infected females pass on the bacteria to their offspring. Eventually the mosquito population crashes and disappears," said AITHM lead investigator and JCU Adjunct Professor Scott Ritchie.

"In the three treatment areas, mosquito populations were reduced significantly to less than 10 per cent of their original population. These populations were then monitored the following year with one of the sites recording a total absence of *A. aegypti* through the wet season," said Professor Ritchie.

"In the last five years, we have seen a reduction in the incidence of dengue of over 95 per cent in North Queensland."

This method is currently being further explored by the World Mosquito Program as a way to control dengue as well as other mosquito-borne viruses including Zika virus, yellow fever and chikungunya virus.

With the lack of effective vaccines for most of these diseases, and environmental concerns about the use of insecticides to control mosquito populations, biological control methods such as the *Wolbachia bacterium* technique are increasingly showing the way forward.

1 Beebe, N. W., Pagendam, D., Trewin, B. J., Boomer, A., Bradford, M., Ford, A., ... & Ritchie, S. A. 2021. Releasing incompatible males drives strong suppression across populations of wild and *Wolbachia*-carrying *Aedes aegypti* in Australia. *Proceedings of the National Academy of Sciences*, 118(41).

2 Ryan PA, Turley AP, Wilson G, Hurst TP, Retzki K, Brown-Kenyon J, Hodgson L, Kenny N, Cook H, Montgomery BL, Paton CJ, Ritchie SA, ... O'Neill SL. 2019. Establishment of wMel *Wolbachia* in *Aedes aegypti* mosquitoes and reduction of local dengue transmission in Cairns and surrounding locations in northern Queensland, Australia. *Gates Open Research*. 3. doi: 10.12688/gatesopenres.13061.1





AITHM's Associate Professor Paul Horwood with PNGIMR researchers

## Partnership Highlights from 2021

### Australia

The Australian Institute of Tropical Health and Medicine's (AITHM) Mosquito Research Team is conducting a trial to test the effectiveness of a new mosquito repellent on behalf of skincare company Australian Blue Cypress Pty. The trial will determine the effective dosage and protection time against *Aedes aegypti* mosquitoes which are key vectors in the transmission of diseases including dengue, chikungunya, Zika and yellow fever viruses. Laboratory trials will involve applying a dose of the Australian-made product to the skin of the volunteers, who are exposed to pathogen-free mosquitoes, reared in the at AITHM's Tropical Medicine Mosquito Research Facility (TMMRF) in Cairns. This trial will be conducted over a period of six months.

AITHM researchers are leading a study with partners from the Cairns and Hinterland and Torres and Cape Hospital and Health Services, to better understand why vaccine immunity against tuberculosis (TB) diminishes in adolescence and adulthood. The study investigates why the only licensed TB vaccine currently available to us, bacille

Calmette–Guérin (BCG), fails to protect against pulmonary TB in adults, and why protection wanes in adolescence. The project involves partnerships with clinicians and nurses in Cairns, Bamaga and Thursday Island and builds on strong support provided by the Torres and Cape Tuberculosis Control Unit.

### Papua New Guinea

AITHM is part of a collective of Australian research organisations who are providing support and mentoring in health and medical research to the Papua New Guinea Institute of Medical Research (PNGIMR). AITHM has researchers based in Papua New Guinea who play a leading role in several large research and capacity building initiatives, including projects aimed at strengthening health systems for vector-borne diseases surveillance and control. Recent work has included the support of training courses and pilot trials in vector surveillance and indoor residual spraying.



### South Pacific

AITHM leads the Pacific Mosquito Surveillance Strengthening for Impact (PacMOSSI) project. This project, funded by the Australian Department of Foreign Affairs and Trade (DFAT) and the Pacific Community, supported by the *Agence Française de Développement* (AFD), involves the World Health Organization and 15 Pacific Island nations, with the aim of improving mosquito surveillance and the control of mosquito-borne diseases across the Pacific region.

### Indonesia

AITHM researchers are leading the mosquito component of a multi-institutional study to support the Indonesian Government in evaluating an emerging disease of monkey-to-human transmission of malaria parasites in Indonesia. The study led by the Menzies School of Health Research with the *Universitas Sumatera Utara* North Sumatra, the Eijkman Institute for Molecular Biology, the University of Melbourne, University of Western Australia, and the University of Queensland, is investigating zoonotic malaria transmission in North Sumatra, North Kalimantan and Sabang, Aceh. AITHM researchers are seeking to understand what is influencing transmission by the *Plasmodium knowlesi* mosquito and the parasite that causes malaria in monkeys with spillover to humans.

### Philippines

The Philippines has been one of the countries most severely affected by COVID-19 in the Western Pacific Region. AITHM epidemiologists worked with national and international partners including Monash University, Ateneo de Manila University, and the University of Hawaii, to support the Philippines Department of Health and the World Health Organization to better understand COVID-19 dynamics in the Philippines. Modelling tools developed by these researchers were used to estimate epidemiological parameters for COVID-19 in the Philippines, consider the effects of non-pharmaceutical interventions (NPIs) deployment during the first wave of transmission, and create scenarios for various policy changes and estimate associated risk of disease resurgence.



### Africa

AITHM researchers, in collaboration with international research partners, have developed a new test using a high-tech chip similar in size to a phone SIM card, to help bring the World Health Organization closer to its goal of eliminating urogenital schistosomiasis. *Schistosomiasis* is an acute and chronic disease caused by the parasitic urinary blood fluke - *Schistosoma haematobium*, which is found in tropical fresh waterways, and affects about 200 million people. While endemic in 51 countries, it is most prevalent in Africa. Researchers from JCU, with collaborators from Africa, Europe, the United States, and Thailand have developed a new point-of-care test strip, similar to a pregnancy test, which can detect early low-intensity schistosomiasis infections. Early detection can allow for early treatment, and prevention of the parasite being passed on to others, interrupting the spread of disease.

### Cambodia

AITHM researchers are working with scientists from the *Institut Pasteur* in Cambodia, in the Asia-Pacific Centre of Excellence for Malaria Research, conducting a wide range of projects and studies including longitudinal cohorts and entomology surveillance to understand residual malaria in forest settings and the development of novel serological tools to guide malaria elimination.



## Unlocking potential of modern medicines from Tropics

*Oyelola Adegboye, Matt Field, Andreas Kupz, Saparna Pai, Dileep Sharma, Michael Smout, Phurpa Wangchuk, Yide Wong, Claire Loiseau*

Rapid developments in technology and emerging specialist expertise could be the catalysts to unlocking a treasure trove of new medicines from the world's natural reserves of tropical plants, according to researchers at the Australian Institute of Tropical Health and Medicine (AITHM).

A two-year comprehensive review investigated improved ways of finding new medical compounds from nature, in order to better tackle diseases of the Tropics.

AITHM Senior Research Fellow and Microbiologist Dr Andreas Kupz said nearly half the world's recognised medications were sourced from nature, including broad-spectrum antimicrobial agents, Quinine from the bark of the cinchona plant for malaria, and medicines with anti-parasitic, antiviral, and anti-fungal disease properties.

"We found that while there is vast Indigenous knowledge around medicinal use of Australia's tropical plants, the underlying active compounds of these plants remain largely unknown," Dr Kupz said.

"The focus of pharmaceutical research in this area has been on flowering plants, whereas mangroves and non-flowering plants, such as mosses, ferns, hornworts, cycads, liverworts and lycopods, remain barely studied for drug development to date, and represent an untapped source of novel compounds.

There is also a bottleneck in the discovery process, as well as the significant financial investment required to take a promising raw natural product forward in order to become a new standard-of-care treatment for a tropical pathogen."

AITHM's microbiologist Dr Michael Smout, said the team of researchers including experts in immunology, molecular biology, bioinformatics, and chemistry, found that while cost and time were barriers to producing new drugs, rapid developments in technology and expertise were changing all that.

"We have access to emerging areas of research knowledge and advancements in technology which is improving identification and isolation of compounds in plants," Dr Smout said.

Principal Senior Research Fellow in Bioinformatics Dr Matt Field said the use of cutting-edge next-generation sequencing technologies in genomics and metagenomics offer new targeted screening pathways for the discovery of natural products.

"Over the past few decades numerous high-throughput sequencing approaches have been developed and applied to facilitate the process of identifying protein and small molecule drug candidates," Dr Field said.



Some challenges can be overcome through strategic collaboration between chemists with expertise in natural products and organic synthetic chemistry, and biologists with expertise in biological processes and sample processing.

"We also increasingly require immunologists with expertise in cell and animal-based assays working with bioinformaticians to develop discovery platforms using large-scale genome sequence mining, and shotgun metagenomics, he said."



"Technology and these emerging areas of expertise that go with them, will ensure more of these natural reservoirs will likely reveal their pharmaceutical secrets in the near future."

The Institute brings together researchers from across JCU to explore and harness the power of the Tropics to develop innovative solutions to global public health problems.

Adegboye O, Field MA, Kupz A, Pai S, Sharma D, Smout MJ, Wangchuk P, Wong Y, Loiseau C. 2021. Natural-product-based solutions for tropical infectious diseases. Clin Microbiol Rev 34:e00348-20. <https://doi.org/10.1128/CMR.00348-20>.



# Tropical Health Security



## International group tracking new zoonotic disease

*Professor Tom Burkot and Dr Tanya Russell*

Mosquito experts from the Australian Institute of Tropical Health and Medicine (AITHM) are partnering with other Australian and international researchers to evaluate an emerging disease in monkey-to-human transmission of malaria parasites across Indonesia, as zoonotic diseases such as COVID-19 increase in frequency and severity.

The two-and-a-half-year multidisciplinary study is investigating zoonotic malaria transmission in three sites in Indonesia – North Sumatra, North Kalimantan, and Sabang in Aceh province – is a part of Indonesia's national progress towards malaria elimination.

The project has brought together molecular, social and agricultural scientists, entomologists, epidemiologists, ecologists, clinicians, and mathematical modellers to both strengthen human surveillance systems and facilitate sustainable agricultural development in the context of rapidly changing environments and infection risks.

Professor Tom Burkot, from AITHM, said multidisciplinary approaches to emerging zoonotic infections were increasingly recognised as the most effective way to understand their complex transmission dynamics.

Professor Burkot and Dr Tanya Russell are leading the study of the mosquitoes responsible for transmission of the parasite that causes malaria in humans, known as *Plasmodium knowlesi*, to better understand the factors that influence its transmission, including the influence of land-use change and environment.

Professor Burkot said *Plasmodium knowlesi* was an emerging malaria parasite of the long-tailed (*Macaca fascicularis*) monkey and pigtailed macaques (*M. nemestrina*), and is transmitted by the *Anopheles leucosphyrus* group of mosquitoes.

"An increasing number of infections have been seen in Indonesia as the parasites spillover from the monkey hosts to human populations," he said.

Dr Tanya Russell said the parasite had not yet evolved the ability for human-to-human transmission (via a mosquito) without the parasites cycling back to the monkey populations, but it may only be a matter of time until *Plasmodium knowlesi* emerges as a human malaria.

"Like many emerging zoonotic infectious diseases, the primary drivers thought to be increasing the transmission rates between hosts, are changing land use patterns, which are related to agricultural development and deforestation," Dr Russell said.

The study also includes human surveillance using molecular detection methods, geospatial risk mapping, social science and health economic modelling, macaque camera trapping, agricultural surveys, and surveillance of mosquito activity in varying habitats.

"This program will enable us to accurately identify monkey malaria cases and evaluate current malaria prevention activities for high-risk groups such as rural farmers in the context of zoonotic transmission."

The highly collaborative research program involves JCU and partners from Eijkman Institute for Molecular Biology in Jakarta, the Menzies School of Health Research in Darwin, and the *Universitas Sumatera Utara*, in North Sumatra.

The Australian Centre for International Agricultural Research (ACIAR) is funding the project as part of the One Health for Systems Strengthening Program.



# COVID-19 Modelling Tool Pinpoints Herd Immunity

*Professor Emma McBryde*

James Cook University (JCU) scientists have developed a new modelling tool, which shows Australia needs to vaccinate at least 85 per cent of the population to achieve herd immunity.

Australian Institute of Tropical Health (AITHM) Professor of Infectious Diseases Epidemiology and Modelling Emma McBryde, said modelling had implications for the Federal Government's national COVID-19 vaccine roll-out announced in July, 2021, which was aimed at enabling Australia to transition from suppression of COVID to a strategy of reopening and a return to normal life.

Professor McBryde's group, which includes modellers from JCU, Monash University, and the Australian National University, developed a tool that provides an optimal strategy for achieving herd immunity.

"Our modelling with the Delta virus suggests that we need around 85 per cent, or 21.5 million Australians, to be vaccinated to achieve herd immunity," she said.

Australian Prime Minister Scott Morrison called for 'good modelling' which was needed in order to enter phase 2 of a "post-vaccination phase" where Australia would need to reach a "threshold of vaccination" based on a scientific, not a political number.

Professor Emma McBryde's team investigated herd immunity thresholds and estimated optimised vaccine distribution around the world for the original Wuhan strain, and repeated the exercise for subsequent variants in Australia.

"The first hurdle is to vaccinate to achieve herd immunity, however herd immunity became more difficult to achieve with the Delta variant, as it was both more infectious and less amenable to vaccination," said Professor McBryde.

AITHM's modelling team was working with countries around our region to investigate herd immunity thresholds and optimise vaccine distribution.

"We show that assuming a reproduction number (the number of people infected by someone carrying the virus) for the Delta variant of 5, we would need to vaccinate 85 per cent of the Australian population," said Professor McBryde.

She said if vaccine coverage followed the mixed strategy (AstraZeneca for people aged over 60 and Pfizer for those under 60) Australia could achieve herd immunity by vaccinating 85 per cent of the Australian population, however this may not be achieved.

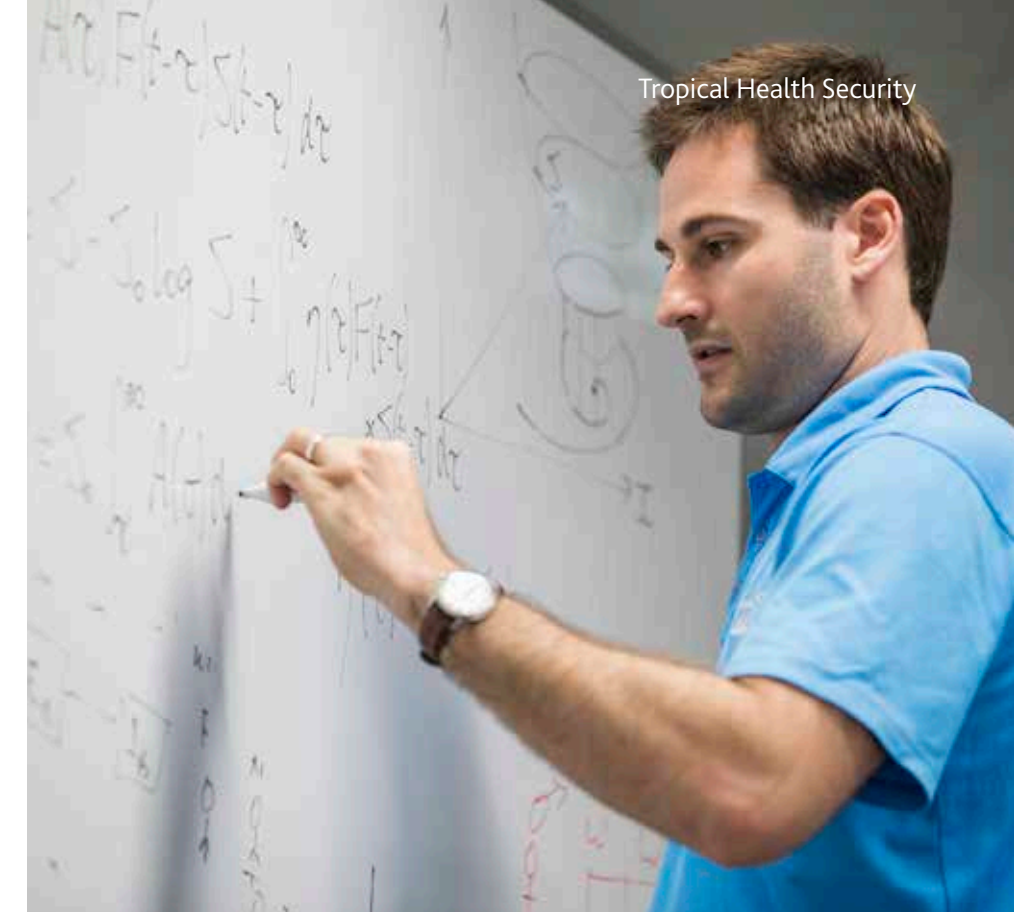
"We have also shown that even without herd immunity, vaccinated people are protected against severe disease and much less likely to be hospitalised or die," said Professor McBryde.

Professor McBryde also advocated for Australia to begin to provide incentives following the example set by the US Centre for Disease Control and Prevention, which extended freedoms for people who were fully vaccinated, to resume activities that they did prior to the pandemic, including travel.

She said the AITHM team concluded the characteristics of the Delta variant made achieving herd immunity extremely challenging.

"But it's important to remember that both vaccinated people and unvaccinated people will still have a reduced risk of infection and disease as Australia gets closer to herd immunity."

A number of our assumptions about the emerging variants are uncertain, in particular just how infectious they are. Also, we are not sure what the vaccine uptake will be or the future age of vaccine eligibility. For this reason, we have developed an online tool that can be modified for different settings and updated as new data becomes available.



Tropical Health Security

## Rapid surveillance key to future of infectious disease modelling

*Dr Michael Meehan*

Australian Institute of Tropical Health and Medicine researcher Dr Michael Meehan is developing a world-leading system to model and analyse the spread of infectious diseases, such as COVID-19.

Dr Meehan is using genetic sequencing data to reconstruct epidemic outbreaks, to enable rapid and effective disease surveillance.

"My approach combines traditional transmission modelling with principles from evolutionary biology to reconstruct ongoing outbreak dynamics," he said.

"These models will allow us to estimate several important characteristics of new and emerging infectious diseases, including the transmission rate and the period of infectiousness."

Dr Meehan said his research aimed to deliver improved intervention systems to enhance Australia's preparedness to respond to any infectious disease threat.

"Current approaches often fail to account for the natural history of infection, the impact of control measures, or the super-spreading behaviour that drives epidemics," he said.

"My concept will help shift the traditional retrospective focus into a real-time analysis and response."

"For what I believe is the first time, my model will consider the natural progression of the infection, the transmission characteristics of individual hosts, and account for different strains of the virus."

Dr Meehan's research will use publicly-available genomic data for common pathogens including tuberculosis, influenza, and SARS-CoV-19, the virus that causes COVID-19, to develop into open-source software.

"I want to make sure these developments are made widely available and adopted," he said.

"Therefore, I aim to develop modelling software that is easily available to relevant organisations to enable rapid and effective disease surveillance."

Dr Meehan also anticipates his research will have non-human benefits as well.

"Because these methods encompass plant, animal, and human hosts, they can be used to monitor and control Australia's agriculture and aquaculture industries as well," he said.

"I have also been working on a model to investigate infectious disease outbreaks in prawn hatcheries in regional Queensland."

Dr Meehan has received a 2021 Australian Research Council Discovery Early Career Researcher Award (DECRA) Fellowship to further this work.





*"Malaria is easily treated, but it is actually hard to diagnose, and because of that there can be over-treatment, which we have seen can lead to the spread of drug-resistant malaria."*

## Magnetic attraction: Breakthrough test for malaria

*Dr Stephan Karl*

After nearly a decade of research, a new test that detects the magnetic properties of malaria-infected blood could soon be used to help eliminate the mosquito-borne disease.

Dr Stephan Karl, a Senior Research Fellow in Malaria and Vector Biology at the Australian Institute of Tropical Health and Medicine, has led an international study to field-test a new tool in the fight to eliminate the malaria, a disease which, according to the World Health Organization (WHO) affected an estimated 241 million people and caused 627 000 deaths worldwide in 2020.

"Malaria is easily treated but it is actually hard to diagnose, and because of that there can be over-treatment, which we have seen can lead to the spread of drug-resistant malaria," Dr Karl said.

"Improving malaria diagnosis, especially through the development of practical methods for resource-limited places, is important and timely."

The international team, which included the University of Augsburg's Professor Istvan Kezsmarki, the Papua New Guinea Institute of Medical Research and the Burnet Institute, developed and tested the method called rotating-crystal magneto-optical detection (RMOD).

Dr Karl said malaria parasites break down blood in such a way that heme molecules in the blood assemble themselves into organic crystallites containing magnetic iron, which is detected by the RMOD method.

"I've studied the magnetic properties of malaria-infected blood since 2006, and we engaged with Professor Kezsmarki's team in 2013 to demonstrate the sensitivity of this test using human malaria parasites," he said.

Professor Kezsmarki said the success of the field study, which involved nearly 1000 suspected malaria patients in a high-transmission area of Papua New Guinea, was an exciting breakthrough.

"After years of in-lab optimisation of the device, in collaboration with Dr Karl, we demonstrated the great potential of RMOD in fast and reliable malaria field tests performed in Papua New Guinea," Professor Kezsmarki said.

"We showed that RMOD performs well in comparison to the most reliable existing method," Dr Karl added.

"It's very promising, as RMOD testing can be conducted after a short training session and provides test results within 10 minutes. From a funding perspective the cost of RMOD testing is very low since no expensive reagents are used."

He said the team aimed to refine the prototype device so that, eventually, performing a test would be as simple as pushing a button.

"There are other hurdles to overcome too. At the moment, the RMOD has difficulty discriminating between current and previous malaria infections and we are working on a solution for this."



*PNG children*

## Battle to stop spread of new drug-resistant staphylococcus

*Associate Professor Paul Horwood*

An Australian Institute of Tropical Health and Medicine scientist is leading a team investigating the spread of new forms of a crippling children's disease in Papua New Guinea (PNG).

Associate Professor of Virology and Viral Diseases, Paul Horwood said community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is spread within the community and is not associated with physically vulnerable people within the healthcare system – as is the case with regular golden staph (MRSA).

He said CA-MRSA is now the primary cause of a bacterial infection destroying the bones of growing children in the highlands of PNG and is also responsible for a host of other ailments ranging from minor to life-threatening conditions.

"Pathogens like CA-MRSA pose a significant threat to human and animal health worldwide, but the complexities associated with

their maintenance and transmission have made them difficult to understand, model, and control," Associate Professor Horwood said.

He said this pathogen has the greatest risk of spread in limited-resource settings, including certain vulnerable communities within Australia, with rates of CA-MRSA infections more than 29 times higher in Australian Indigenous populations when compared to non-Indigenous Australians.

Associate Professor Horwood has now been granted more than \$600,000 by the National Health and Medical Research Council to investigate the problem.

"We're going to identify the factors that explain the distribution and diversity of CA-MRSA strains in traditional communities and animal reservoirs and provide the fundamental biological knowledge necessary to help predict its future spread, he said."

"We'll identify the epidemiological risk factors and provide a framework to enable evidence-based decision making to combat CA-MRSA in PNG, Australia, and worldwide."

Associate Professor Horwood said the setting of the study in PNG will lead to more effective and cheaper treatment within PNG and improve methods of combating CA-MRSA and other pathogens in other resource-poor countries.

"Existing surveillance systems are not able to provide early warning or detect antibiotic resistant pathogens and are poorly linked to other systems necessary for a strong response to infectious disease threats," he said.

"So, building capacity and strengthening surveillance and health system responsiveness in PNG is obviously essential for the health security of PNG, Australia, and the region."







***“Current national datasets are very good at informing national strategies for suicidal behaviour, however nuances can and do occur at a regional level, and there are distinct differences already emerging from our dataset, in terms of self-harm methods and the overall incidence rate.”***



## Big time research

### *Professor David Whitmore*

AITHM is poised to join world pioneering research into how the human body clock, which governs daily fluctuations in the immune system, may influence vulnerability to tuberculosis infection – as well as the optimum time to deliver drugs to treat the disease.

The multi-disciplinary research team in Townsville, which includes immunologist, Associate Professor Cathy Rush, microbiologist, Associate Professor Jeff Warner and Head of Biological Sciences, Professor David Whitmore, also aims to expand basic knowledge of circadian microbiology; whether bacteria, such as *Mycobacterium tuberculosis*, possess their own biological clocks, and if so, are they geared to maximise opportunities to infect humans.

“The day-night cycle is a strong biological stimulus that we kind of take for granted,” observed Professor Whitmore, former University of College London, Professor of Chronobiology, Cell & Developmental Biology.

“But with few exceptions, it has effectively been incorporated into every animal and plant on the planet. They have all evolved internal clocks that regulate their biology to match the day-night cycle. And not just one clock. Individual organs each have their own clock. Even individual cells. The view now is that there’s probably a clock in almost every cell in the human body.

“Cells mostly go through mitosis (division) just before dawn. So there’s a direct link between the biological clock in the cell and regulation of the cell division cycle. That has major implications for cancer biology.”

Disruption of normal day-night clock-regulated cell division, due to shift work or even chronic jetlag, triggers random cell division that can expedite the growth of tumours. Studies have shown that nurses

who undertake sustained periods of night shifts have a significantly heightened risk of developing breast cancer.

Conversely, the use of chronotherapy (the delivery of treatment at a specific time, based on the circadian cycle, to maximize therapeutic effectiveness) has been successfully utilised by Paris oncologist, Francis Levi, to achieve an approximate 22 per cent increase in patient survival and reduced treatment side effects, by optimising the time of day he delivers chemotherapy.

With the help of graduate student Paige Bauer, the researchers have begun to develop a Zebrafish model of TB, as the fish version of TB is genetically very similar to human TB.

This model will be used to investigate how circadian rhythmicity modulates immune functions, in response to infection. The results will improve understanding of the mechanics involved in host-microbe interactions in TB. The aim is to utilise this information to enhance the treatment and management of an infectious disease.

Professor Whitmore’s study of Zebrafish dates back to post-doctoral research undertaken at the *Institut de génétique et de biologie moléculaire et cellulaire* (IGBMC) in Strasbourg, and further work with developmental biologist and Nobel Prize winner, Professor Christiane Nusslein-Volhard at the Max Planck Institute for Biology Tübingen, where he and Professor Nicholas Foulkes first demonstrated that a circadian clock system existed within all organs of the fish, rather than a specialised brain structure, as commonly believed. Their findings were published in *Nature* in 2000 and *Nature Cell Biology* in 2005.

Professor Whitmore is confident AITHM will have Zebrafish in house and providing new insights into tuberculosis by the end of 2022.

## The cost of self-harm

### *Mr Chris Rouen*

Self-harm is a significant indicator of future death from suicide. The full extent of self-harm in Australia is unknown. It is widely accepted that the number of cases identified and treated in hospitals is just the tip of the iceberg. However, accurately gauging the cost of these hospitalisations will highlight the economic impact of this largely hidden, and often stigmatised, health issue.

In an Australia-first study, JCU Health Economics researcher, Christopher Rouen, calculated the economic cost of self-harm hospitalisations in Far North Queensland; information which could help prompt, tailor and evaluate future therapeutic and preventative strategies in the region.

Far North Queensland’s demographic profile flags elevated risks of self-harm, including a higher proportion of the population that identify as First Nations people; are socio-economically disadvantaged; and live in remote and very remote areas when compared to the rest of Queensland.

Self-harming behaviours and intentions range from superficial cutting and deliberate recklessness that may cause harm to near lethal suicide attempts, such as hanging and severe cases of self-poisoning.

Utilising hospitalisation and cost data from Queensland Health, Mr Rouen sought to identify and cost self-harm admissions in the Cairns and Hinterland Hospital and Health Service and Torres and Cape Hospital and Health Service regions between 2012 and 2018.

It was a challenging task.

“The way self-harm is categorised in coding data is by injury diagnosis. Self-harm is not a diagnosis in itself, it’s an external cause of injury,” Mr Rouen said. “Clinicians have to first determine if there was an intent to self-harm. It is feasible that some patients deny their injury was intentional.”

The study identified 3,899 self-harm hospitalisations (involving 2,817 individuals aged over 15 years), during the seven-year period; an incidence rate of 254 per 100,000 population. The equivalent national rate for the same period was 146 per 100,000.

The total cost of treatment for the FNQ patient group was \$29.4 million. The average cost per admission was \$7,536.

The researcher also identified significant demographic and clinical trends. Self-poisoning accounted for 73 per cent of hospitalisations, 19 per cent were due solely to self-injury (such as hanging, cuts and falls from height) and the remaining a combination of self-poisoning and self-injury methods.

Women accounted for 59 per cent of hospitalisations and the greater share of total treatment costs, but their individual clinical costs were less than males, who tended to use more lethal methods of self-harm. The average cost of treatment increased with age, regardless of gender.

Twenty-one per cent of hospitalisations involved people who identified as First Nations, (which represent approximately 13 per cent of the FNQ population). Hanging accounted for 20 per cent of these hospitalisations, compared to four per cent in non-First Nations people.

Mr Rouen believes his dataset will equip both hospital services and suicide/self-harm prevention groups with the necessary evidence to advocate for the development of regionally focussed health strategies. He has already embarked on further analysis of his findings.

“Current national datasets are very good at informing national strategies for suicidal behaviour, however nuances can and do occur at a regional level, and there are distinct differences already emerging from our dataset, in terms of self-harm methods and the overall incidence rate.”



# Diseases of High Burden in the Tropics

## Northern Australian parasites key to diabetes cure

*Distinguished Professor Alex Loukas & Dr Paul Giacomini*

Australian Institute of Tropical Health and Medicine (AITHM) and its latest spin-out company, Macrobiome Therapeutics have set their sights on developing new treatments for Type 2 diabetes – with a little help from Northern Australia's unique array of parasitic worms.

Federal Minister for Northern Australia the Hon David Littleproud visited the Institute's Cairns laboratories in September 2021 to announce a new \$2.2 million research and development venture, which is partly funded by the Cooperative Research Centre for Developing Northern Australian (CRCNA).

"Our investment in Northern Australia has led to some remarkable and potentially lifesaving research," Mr Littleproud said.

Professor Alex Loukas and Dr Paul Giacomini, researchers at AITHM and Macrobiome Therapeutics, said clinical trials have already tested whether parasitic worms, such as hookworms, could potentially protect infected humans from developing Type 2 diabetes.

"When a hookworm is in the body it secretes proteins that target inflammation, which is a major contributing factor to some metabolic conditions, including Type 2 diabetes," Dr Giacomini said.

"We are interested in identifying the hookworm secreted proteins which suppress the inflammatory pathways that promote diabetes and other inflammatory conditions," he said.

Now, Macrobiome and AITHM want to target these proteins and replicate them in the lab using pharmaceutical industry standards. They will test the protein molecules and determine which are best suited to the next stage of development and possible further clinical development and trials.

Professor Loukas said they take their inspiration from the diverse tropical flora and fauna which surround them in Northern Queensland, where unique parasites and plants abound and present an untapped, rich source of next-generation therapeutics.

"Evolutionary biology has ensured that these ancient worms and other commensal or parasitic organisms have evolved to live inside humans while causing as little harm as possible. Our goal is to exploit this remarkable example of coevolution and harness it to develop entirely novel and safe medicines," Professor Loukas said.

CRCNA Chair Sheriden Morris said if successful, the results of the project would be a game changer for millions of Australians.



"There's a massive cost imposed on the Australian healthcare system treating people with Type 2 diabetes – with around \$14.6 billion spent annually – many of whom live in Northern Australia," she said.

"If we can work towards a cost-effective treatment which may prevent the onset of the disease, then those resources could be diverted to tackling other chronic diseases and bolstering the delivery of health care across Northern Australia."





## Getting to the guts of Coeliac Disease

*Dr Paul Giacomini*

Researchers at the Australian Institute of Tropical Health and Medicine (AITHM) have found gut parasites with immune-modulating powers could hold answers to painful gut health issues like coeliac disease.

In clinical trials, a team led by scientists from the Institute, and partner clinicians Dr Tony Rahman and Dr John Croese at Brisbane's Prince Charles Hospital, have seen promising new findings in the potential of parasites to restore gluten tolerance in patients with coeliac disease.

AITHM immunologist Dr Paul Giacomini, who led the study at James Cook University, will continue researching the potential benefits of gut-dwelling hookworms – with a focus on how these worms may change the gut environment to prevent coeliac disease reactivation after exposure to low levels of gluten.

Dr Giacomini said helminth parasites such as hookworms had co-evolved and adapted to their human host, such that infections in well-nourished people are safe and well tolerated. Hookworms can induce changes in the immune system that activate or suppress its function, which helps the parasite survive and may have an unexpected collateral effect on other, unrelated inflammatory conditions of the host.

"We know coeliac disease is an autoimmune disorder where an immune response arises in the intestine after gluten consumption, and we are furthering some studies which have suggested hookworm infection in the small intestine may restore gluten tolerance," he said.

"We undertook a randomised, placebo-controlled trial of hookworm infection in 54 people with coeliac disease, and there was some compelling evidence that emerged."

The team has been granted funding from Coeliac Australia to undertake a series of advanced laboratory analyses focusing on the gut reactions.

This is expected to reveal answers behind the hypothesis that hookworms are likely to create an anti-inflammatory environment in the gut, as well as beneficial changes in the balance of healthy and unhealthy microbe, which together favour the development of improved gluten tolerance in coeliac disease.

Greater understanding of the biological mechanisms that lead to improved gluten tolerance, will advance the development of new treatments such as immunomodulatory therapies, or probiotics for people with coeliac disease.

## Kidney research gets boosted

*Professor Andrew Mallett*

Townsville researcher and Australian Institute of Tropical Health and Medicine member Professor Andrew Mallett will lead a new \$3 million national research program, which aims to improve the lives of Australian families with genetic kidney disease.

The Professor of Medicine at James Cook University said that, of those who are identified as having kidney disease, about one in 10, and up to 50 per cent of affected children, have an underlying genetic cause as to why they have developed the disease.

"For those patients, we're fighting a few different battles. The first is detecting that they have kidney disease, particularly when you can lose almost all of your kidney function with no symptoms or signs," Professor Mallett said.

"The second issue is identifying those who have an underlying genetic cause for why they've developed the disease, where it's an issue that may not only affect them personally but also their family members."

The KidGen National Kidney Genomics Program will receive \$3 million over four years from the Federal Government's Medical Research Future Fund via its Genomics Health Futures Mission.

Professor Mallett, who is also Director of Clinical Research and a nephrologist at the Townsville Hospital and Health Service, and National Director of KidGen, said the funding would help expand diagnoses from 45 per cent to 70 per cent of his patients.

"We know there are probably genes that are associated with kidney disease which we haven't found yet and there are changes in genes we already know about that we can't see with our standard diagnostic genomic sequencing," Professor Mallett said.

"That raises questions as to whether there are genes that we should know about which may be causing kidney disease, and also, are other types of cutting-edge genomic sequencing or data analysis able to find genetic changes that we just can't see with our current methodologies."

"A program like KidGen helps us to begin to do that, particularly when we have a large national network of multidisciplinary clinics already set up seeing hundreds of patients and families every single year."

Professor Mallett said one in three Australians is at risk of kidney disease and one in eight have kidney disease. It is estimated that about a million Australians have the disease, but don't know it. The four-year program is expected to lead to new and innovative treatments.







*"Being able to breed Irukandji in captivity will enable us find the answers to questions like how long they live for, how fast they grow, and what their environmental thresholds of temperature and salinity are."*



## Breakthrough in breeding Irukandji jellies in captivity

*Professor Jamie Seymour & Dr Robert Courtney*

In a world-first, renowned venomous jellyfish expert Professor Jamie Seymour and his team of researchers at AITHM have managed to breed the extremely venomous species of box jellyfish, the Irukandji *Carukia barnesi*, in captivity.

At just the size of a thumbnail, the Irukandji jellyfish is the smallest and also one of the most venomous species of box jellyfish in the world, with stings so severe that they can cause fatal brain haemorrhages.

Although previously successful in collecting Irukandji adults and getting them to spawn, getting the eggs to hatch required a finely tuned approach to the handling of the Irukandji's polyp phase, and a healthy dose of perseverance.

"I spent my PhD looking into the thermal and osmotic tolerance of the polyp stage of the Irukandji, which provided new insights into the polyp's habitat suitability. Combinations of temperature, salinity and feeding frequency were all studied as cues for getting the polyps to reproduce asexually or what is termed 'budding'," said Senior Researcher Dr Robert Courtney.

"Another critical factor was to extend the observation period of the development and hatching timeframes of the eggs. What we found is that the eggs of the Irukandji jellyfish can enter a dormant phase and take up to six months to hatch."

The ability to now breed Irukandji eggs in captivity allows for an expansion of research to take place which could include developing an early forecast system for expected locations and breakouts of the species.

"Being able to breed Irukandji in captivity will enable us to find the answers to questions like how long they live for, how fast they grow, and what their environmental thresholds of temperature and salinity are. All of this information will allow us to better predict when and where Irukandji are most likely to occur, which then has the potential to save lives," Professor Seymour said.

Although an anti-venom for the intensely painful Irukandji sting is not on the immediate horizon, due in part to having at least eight different Irukandji species in Australia alone, more research into their venom will hopefully uncover new and effective treatments for the famously painful sting and symptoms, known as Irukandji Syndrome.

"The breeding of large numbers of the Irukandji jellyfish in captivity will give us the large volumes of venom that we need for this type of research to take place," Professor Seymour said. "By studying the venom, we can also investigate what novel compounds from the venom could possibly be developed for other therapeutics."

"In regard to the Irukandji venom, one of the things you see typically is an increase in people's blood pressure after they have been stung. And we think this comes about because of an increase in the stimulation of adrenaline in your body. So we may be able to pull out from the Irukandji venom the compound that causes adrenaline spikes. This could lead to a new therapeutic compound being developed for people who need adrenaline, such as in the event of a heart attack."



## Crickets on the dinner plate by 2050 – but are you allergic?

*Professor Andreas Lopata*

Crickets and other insects could be key to feeding the world's population, estimated to reach 9.7 billion people by 2050, but new research suggests bugs could pose health risks for those with shellfish allergies.

Professor Andreas Lopata, a leading expert on shellfish allergy at the Australian Institute of Tropical Health and Medicine, said more than 2 billion people around the world already eat insects daily.

Crickets are high in protein, nutrient dense and considered environmentally friendly, and studies have shown eating insects provide benefits to gut health, and lower blood pressure while being high in antioxidants.

However, Professor Lopata said because insects and crustaceans both belong to the arthropod family, people with shellfish allergies could be at high risk of potentially severe allergies to insect proteins.

In a collaborative project with partners from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), including Edith Cowan University, Singapore's National Agency for Science Technology and Research and the Tropical Futures Institute, the team identified and compared 500 proteins from roasted whole crickets and cricket powder products with over 2000 registered allergens.

Professor Lopata said the research showed a significant overlap in allergenic proteins found in cricket food products and those found in shellfish like crabs and prawns.

"Shellfish allergies affect up to three per cent of people globally, but that varies according to age and region, and there's a high risk that people allergic to shellfish will also react to insects," he said.

Professor Lopata said containing an allergen does not prevent insect-based proteins being used as an alternative food source, but it does mean insect-based foods would need to be tested and labelled correctly to ensure people with allergies don't unwittingly eat them.

The findings for this work 'Protein extraction protocols for optimal proteome measurement and arginine kinase quantitation from cricket *Acheta domesticus* for food safety assessment' was published in the journal Food Chemistry June 30, 2021.

**Australia has 14 active insect farms in 2021; of these, 10 produce insects for animal feed and four produce insects for human consumption.**





Dr Andreas Kupz and Professor Hugh Possingham

## Developing new protection against Tuberculosis

### Dr Andreas Kupz

The year 2021 will no doubt be remembered for COVID-19, but it also marks 100 years since the first vaccine for tuberculosis (TB), the bacille Calmette-Guérin (BCG) vaccine was administered, and researchers are getting closer to finding a more effective vaccine.

Australian Institute of Tropical Health and Medicine Senior Research Fellow Dr Andreas Kupz, said although the anniversary of the BCG vaccine was a cause for celebration, tuberculosis remained a global threat and a national public health concern on a scale similar to COVID-19.

Tuberculosis is listed by the World Health Organization as one of the 'big three' international infectious diseases alongside HIV/AIDS and malaria.

Dr Kupz has embarked on a biological arms race to develop an effective life-long vaccine in the face of steadily growing drug resistance to the disease.

He said while the original BCG vaccine saves thousands of children's lives every year, in most cases it does not provide protection as people reach adulthood, and so he is working to genetically enhance BCG to protect adults as well.

"The development of a new and effective TB vaccine is crucial if the disease is to be significantly reduced, let alone eradicated, within the coming decades," Dr Kupz said.

In 2019, an estimated 10 million people fell ill with TB and 1.4 million people died. Of those cases, around 60 per cent were in Asia and 24 per cent in Africa.

"The efficacy of BCG wanes over time, and protection against TB is often lost by adolescence or early adulthood," he said.

"Importantly, BCG fails to prevent active lung TB in adults, the most important driver of ongoing transmission and cause of death."

Dr Kupz said COVID-19 has shown the enormous harm pathogens can cause to societies and economies, and he has called for more long-term funding to be made available.

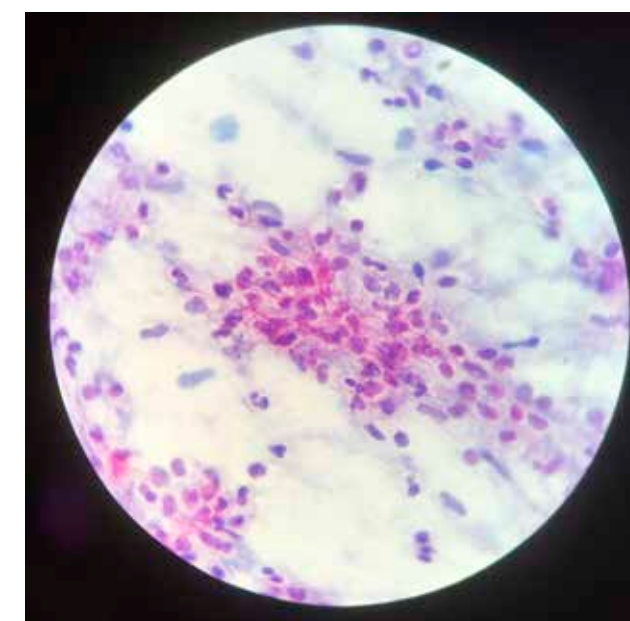
"Investment into infectious disease research and vaccine development is but a fraction of the economic cost of a pandemic," he said.

While TB no longer has a high incidence in Australia, it is still an issue in remote Indigenous communities.

"Papua New Guinea, Australia's closest neighbour, has one of the highest incidences of multidrug-resistant TB and one of the lowest BCG coverage rates globally."

Dr Kupz said the introduction of TB into Australia via the Torres Strait, with a high proportion of cross-border diagnoses in North Queensland and over-representation of Indigenous children, is a national public health concern.

"Importantly, we have seen resistance to current TB treatments increasing steadily," he said.



***"The introduction of TB into Australia via the Torres Strait, with a high proportion of cross-border diagnoses in North Queensland and over-representation of Indigenous children, is a national public health concern."***

"Treatment of multidrug-resistant TB is hugely expensive and can take up to two years, requiring patients to take multiple antibiotics, sometimes daily, and close monitoring.

"Now is the time to put in the financial and political will into a renewed effort to finding a more effective TB vaccine."

Tuberculosis is caused by the bacterium *Mycobacterium tuberculosis* and transmission happens via inhalation of droplets and aerosols coughed up by an individual with active TB.

It is estimated that approximately 2 billion people are latently infected with TB. Although most latently infected individuals are not sick and do not transmit the disease, in about 10 per cent of these people the disease reactivates.

"It is clear that the development of an improved TB vaccine that also works in adults is critical in order to reach the World Health Organization goal of TB elimination," Dr Kupz said.

Despite the BCG vaccine being 100 years old, the mechanism by which BCG works is largely unknown.

"It is unclear why, in most cases, BCG only confers protection against childhood versions of TB and why protection wanes in adolescence," he said.

TB research and preclinical vaccine development is logistically challenging and requires special biological containment facilities. The short-term and fiercely competitive environment for government and philanthropic research funding makes it difficult for academics to commit to TB vaccine research as a career path.

However, Dr Kupz said he was encouraged by the pace at which COVID-19 vaccine development had occurred, showing what is possible when the political will, pharmaceutical interest, and funding is there.



# Tropical Health Systems



## Australia loses \$40 billion each year to poor sleep

*Dr Yaqoot Fatima*

Research has supported the findings that a good night's sleep supports brain function, muscle repair, and metabolism.

Sleep expert and Australian Institute of Tropical Health and Medicine researcher Dr Yaqoot Fatima, a Senior Research Fellow based at James Cook University's Murtupuni Centre for Rural and Remote Health in Mount Isa, was part of a team of researchers who looked deep into the sleep patterns of more than 4600 Indigenous children aged up to 17 years old.

Dr Fatima, a 2021 Queensland Young Tall Poppy Science Award winner for research excellence, said the review found Indigenous Australian children suffer disproportionately from sleep problems.

Dr Fatima said that what the research team found were health disparities for Indigenous children including higher rates of obesity, diabetes, and respiratory problems.

"School attendance rates are 10 per cent lower among Indigenous children than non-Indigenous children, with higher levels of academic underachievement," Dr Fatima said.

"As poor sleep shares a relationship with health problems and gaps in education, it is important to put sleep health into this context."

She said insomnia symptoms in Indigenous children varied in the studies from 15 per cent to 34.7 per cent. Indigenous children reported severe daytime sleepiness (20 per cent), short sleep (10.9 per cent) and late sleeping (50 per cent).

Snoring was reported in 14.2 per cent of children in a community study, with a sleep laboratory-based study suggesting this prevalence was up to 85 per cent.

"Compared with non-indigenous children, Indigenous children are significantly more likely to experience short sleep duration, and a high proportion of sleep disordered breathing," Dr Fatima said.

She said there was a lack of nationwide data on the prevalence of sleep problems, but there is some evidence to suggest Indigenous children suffer disproportionately from sleep health issues and that both social and biological determinants that play a role.

"Access to sleep health care is lacking for Indigenous children. Data from sleep clinics shows Indigenous Australians attend at the rate of 31 per 100,000 people while the rate for non-Indigenous people is 575 per 100,000," Dr Fatima said.

She said timely access and availability of sleep care services and follow-up are currently major barriers to treatment.

"When appropriate services do become available to them, significant proportions of Indigenous patients are found to be compliant with treatment plans and have derived significant benefits from treatment," Dr Fatima said.



# Community keeps research on track

*Associate Professor Felecia Watkin Lui, Sanchia Shibasaki, Lynda Ah Mat*

Workshops being hosted on Waibene (Thursday Island) at the Australian Institute of Tropical Health and Medicine, recently renamed Ngulaigau Mudh ('house of knowledge'), are empowering community members to proactively drive and engage in research.

Torres Strait Islanders and representatives from the JCU Indigenous Education and Research Centre (IERC), facilitated the 'Community Keeping Research on Track' workshops, which aim to help participants understand their research rights and how to ethically partner with visiting researchers.

JCU Associate Professor Felecia Watkin Lui, Dr Sanchia Shibasaki, and Ms Lynda Ah Mat lead participants through a problem-solving game that required open-mindedness, project management, and communication skills.

Associate Professor Felecia Watkin Lui said evidence shows that when communities as end-users are proactively engaged in research, there is increased support and advocacy for change, as well as greater interest in seeing research results translated into policy and practice.

Curriculum for the workshops was adapted from the National Health and Medical Research Council's Keeping Research on Track (2018) which identifies eight steps in the research journey. The team focussed on the first two steps of 'Building Relationships' and 'Developing the Research Idea'.

Workshop participant Mr Frank Cook said he was proud to attend the workshop because it was run by Torres Strait Islanders who understand their people, the culture, and their own community.

"We are one of the most researched people in the world and we don't often have a say in how that research is conducted or how it will be used once it leaves our region," Mr Cook said.

"This workshop taught me how to better negotiate and utilise research for our benefit."

Mrs Regina Turner, who also participated, said she connected with the workshop as a Board member of the Mura Kosker Sorority, a specialised counselling service that provides support to perpetrators, victims and child witnesses to domestic and family violence.

"In the past, our Board has worked with universities and researchers, but we didn't receive any feedback or see results," Mrs Turner shared.

"This workshop allowed me to reflect on those relationships and made me consider how we could have approached them differently."

The project was funded and supported by HOT NORTH, the Australian Research Council, the Australian Institute of Tropical Health and Medicine, and the Indigenous Education and Research Centre at JCU.



*"During the pandemic it's thought 81 per cent of the global workforce were impacted by full or partial workplace closures, including the requirement for many people to work from home."*



## Work from home needs more Homework

*Dr Jacqueline Reznik*

As COVID-19 continued to force lockdowns, new research shows that workplaces must address the challenge of the growing number of flexible working from home arrangements, to safeguard the mental and physical well-being of employees.

Dr Jacqueline Reznik, a clinician physiotherapist is leading research into challenges relating to widespread home-based work arrangements in the wake of the pandemic.

"Before the pandemic, it's estimated just under eight per cent of the world's workforce worked from home. During the pandemic, it's thought 81 per cent of the global workforce were impacted by full or partial workplace closures, including the requirement for many people to work from home," Dr Reznik said.

Although working from home has reduced travel time and costs, together with expenditure related to eating out, many workers have found themselves exercising less and eating more while at home.

"We wanted to look at some of the problems of home-based work, and ways workers can support themselves physically and psychosocially, whether in future crises or if home-based work becomes common practice in the future," Dr Reznik said.

"A 2020 study, of 51 mobile office workers found more than 40 per cent experienced low back pain and more than 20 per cent experienced neck and other pain – with these percentages increasing over time," Dr Reznik said.

Dr Reznik, a recognised international tutor in neurological physiotherapy, said problems included incorrect seating positions, with the majority of these being too low, improperly adjusted armrests, few corrective lumbar supports, monitors either too low or incorrectly centred, and poor lighting.

"Workers would do well to employ the guidelines provided by employers and/or utilise the resources available online to create a healthy workstation," Dr Reznik said.

She said psychosocial issues are also common, including increased feelings of isolation, decreased work-life balance, loss of motivation, and escalation in stress and anxiety.

Despite the related challenges, the benefits of working from home suggest more workers seek this option, and more employers will support workers to make this choice.





***"There are more than 4400 amputations each year in Australia as a result of diabetes, the second-highest rate in the developed world, and North Queensland has the highest rate of amputations in the state."***

## Research supporting health in diabetes epidemic

### *Professor Usman Malabu*

Townsville-based researchers are developing new solutions to the diabetes epidemic through innovative research such as electromagnetic stimulation therapy, and ground-breaking clinical trials.

Australian Institute of Tropical Health and Medicine research member Professor Usman Malabu heads the Translational Research in Endocrinology and Diabetes (TREAD) program which includes a team of 18 researchers and clinicians, who are driving patient-centred research that is contributing to an expanding body of knowledge on diabetes.

The collaboration includes endocrinologists at the Townsville University Hospital and JCU researchers, who are pioneering novel landmark studies to diagnose, treat, and monitor diabetes and its complications.

Professor Malabu said solutions being developed include new technologies in electromagnetic stimulation and shockwave therapies for diabetic foot ulcers and the use of a new diagnostic marker to diagnose diabetic foot infections in rural and remote areas.

"The novel diagnostic marker we've established enables rapid diagnosis of diabetic foot infections," Professor Malabu said.

"In addition to faster diagnosis, we have found that it is more effective to heal diabetic foot ulcers using shockwave therapy. Our hope is that this novel therapy may serve as usual care for patients with diabetic foot ulcers in the future."

In the past year, Professor Malabu has contributed to eight publications on aspects of type 1 and type 2 diabetes, including self-

***Queensland has 19,000 new type 2 diabetes cases each year, with 160 new cases diagnosed each day – that's one person diagnosed every nine minutes.***

management of the conditions and the long-term outcomes from diabetic foot ulcers and amputations.

TREAD is facilitating ground-breaking clinical trials, and is now offering new treatment options for patients aimed at combating diabetic limb ulcers and amputations. A recent trial on electromagnetic stimulation tested the technology on 100 patients with diabetic foot ulcers.

"Electromagnetic stimulation and shockwave therapies target deep inside the wound and increase circulation in that area. Good circulation is a critical component to wound healing," Professor Malabu said.

"The studies showed a huge difference in the quality of lives for people with diabetic foot ulcers and a significant reduction of time it takes to heal – from years to months."

TREAD is also training and educating the next generation of diabetes researchers, mentoring JCU students on more than 15 projects, including four Honours medical students and four Master and Doctor of Philosophy candidates in the 2020-2021 academic year.

## New digital health platform being designed to close health gap

### *Professor Sarah Larkins & Professor Ron White*

Digital technology is being harnessed to advance healthcare across Northern Australia, via a Northern Australian Regional Digital Health Platform.

The platform, to be designed with technical and health experts from James Cook University (JCU) and partners including the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Optus, local business, and regional communities, will create jobs, and address the unique challenges of delivering healthcare across rural, remote and regional areas.

Dean of the JCU College of Medicine and Dentistry and Professor of Health Systems Strengthening Sarah Larkins said while digital health is a rapidly advancing area, much of this activity has been focussed on metropolitan areas, with little focused effort for application in rural, remote, and regional areas where it has tremendous potential to improve health service delivery.

"There is a growing divide between digitally-enabled cities and Northern Australia's regional, rural and remote communities. "Digital health applications have the capacity to help address the impact of distance, socio-economic disadvantage, poorer health outcomes, and the relative under-supply of professionals in non-metropolitan communities," Professor Larkins said.

"The new health platform is expected to support the development of an innovative new high-value health industry in regional Australia, stronger relationships between industry and the university sector, more jobs and improved health outcomes for rural, remote, and regional communities."

The research and development stage of the project is set to begin thanks to a \$2 million grant awarded in 2021, from the Federal Government's Strategic University Reform Fund (SURF) which will support JCU to pilot local innovation projects which may then be scaled-up or more widely-adopted.

Federal MP for Leichhardt Warren Entsch said the investment strengthened JCU's position as a leader in tropical health and medical research, and said the project would improve health outcomes in communities throughout Northern Australia.

"The research being conducted in North Queensland at JCU, is among the best in the country when it comes to advancing healthcare in the tropical regions of Australia," Mr Entsch said.

"It is great to see JCU taking these challenges on and through this project I hope we will one day see new digital technologies developed and rolled out to suit the specific needs of individual communities and their residents."

This platform is expected to add significant value to regional development projects such as the developing TropiQ - Townsville Tropical Intelligence and Health Precinct and the new Cairns Health and Innovation Precinct.







*The project region is bounded by the five Hospital and Health Services from Mackay to the Torres Strait and the Northern Territory border.*

## Designing Health Care Roadmap for Northern Australia's Health and Prosperity

*Sarah Larkins, Stephanie Topp, Maxine Whittaker, Alex Edelman, Nishila Moodley, Karen Johnston, Deb Smith*

A team of researchers from the Australian Institute of Tropical Health and Medicine and the Tropical Australian Academic Health Centre (TAAHC) are undertaking a project to improve the responsiveness and effectiveness of health services to North Queenslanders, and share the findings with partners across Northern Australia.

Principal Investigator Professor Sarah Larkins said that through the Integrating Health Care Planning Project, the team aimed to identify community health needs, and the gaps and duplication in services, which will help communities redesign existing models of care.

The project follows on from the team's previous collaboration with the Cooperative Research Centre for Developing Northern Australia (CRCNA) through which they conducted a situational analysis of healthcare delivery across the three Northern Australian jurisdictions: northern Western Australia, Northern Territory, and north Queensland.

"We found health systems in the North were struggling to meet the needs of Northern Australia's 1.3 million residents, with poorly targeted resources and ill-suited funding models," Professor Larkins said.

"Investing in the health workforce and related improvement in models of care can be a strong economic driver for prosperity; and as we know, a healthy community is a necessary prerequisite for economic development."

"This project provides a unique opportunity to unite health industry partners and engage with local communities to improve efficiencies and effectiveness in service planning and delivery."

JCU data manager and Senior Researcher Dr Karen Johnston is using an ArcGIS mapping tool to assist in collating and visualising a huge range of information from various sources.

This information will offer a visual map to help the team develop ways to formulate change proposals, for the benefit of communities.

"Data that helps us understand communities, their health needs and services that deliver care, tend to be scattered around the place," Dr Johnston said.

"We are bringing this data together to enable people working in communities and services, to plan for their local area to improve responsiveness."

The project's Manager Dr Deb Smith said during the second phase of the project, stakeholders in four prioritised communities would co-design and implement new models of care, with evaluation to measure the impact of these changes to follow.

The project is funded by the Cooperative Research Centre for Developing Northern Australia (CRCNA) as part of the Australian Government's Cooperative Research Centre Program, and the Tropical Australian Academic Health Centre (TAAHC), with in-kind contributions from health partners.

## Reaching for your words: the link between upper limb movement and language recovery in stroke survivors

*Associate Professor Ruth Barker*

Neural networks that play a role in both arm and hand (upper limb) movement and language function are being put to the test in an innovative Australia-wide trial that could result in global implications for the recovery of stroke survivors.

Losing arm, hand and language functions after a stroke currently affects one in six three months post-stroke and remains an unmet need long-term.

The multi-site phase II clinical trial, called UPLIFT (UPper limb and Language Impairment and Functional Training), will conduct interrelated rehabilitation processes with stroke survivors, targeting neural centres that control both arm and hand movement and language. Townsville is the only regional centre taking part in the phase II trial with Associate Professor of Rehabilitation Ruth Barker leading the trial as Chief Investigator.

"Sites in the brain used for language function and for the arm and hand sit closely together, and so the hypothesis in a nutshell is if we train these areas of the brain together, we'll get a better recovery. But in saying that, we have to work out how much training to give to maximise recovery and how exactly to do that training, which is what the UPLIFT trial aims to do," Associate Professor Barker said.

The trial site in Townsville is a collaboration between AITHM and the Townsville University Hospital, with rehabilitation physician Dr Paul Chapman as site coordinator. Support for the trial is also being provided by JCU lecturer in Physiotherapy, Dr Moira Smith and JCU PhD student, Briede Neibling.

"Having a regional centre involved in this innovative, national trial is important from both a clinical and research perspective. It reminds urban centres of the need to develop rehabilitation programs with people from regional areas, and also gives us the opportunity to keep our researchers engaged at a national level," Associate Professor Barker said.

The UPLIFT trial will follow an 'umbrella' trial design and is the first of its kind to do so globally in regard to stroke recovery.

"The benefit of using an umbrella trial design is that we can evaluate multiple UPLIFT interventions based on dose (two hours or four hours) and mode of delivery (in-person or telehealth) within the one trial. This design allows the research team to drop off interventions that are not showing sufficient promise, which in turn enables us to fast track the establishment of evidence for UPLIFT as a new model of rehabilitation," Associate Professor Barker said.

Recruitment of speech pathologists, physiotherapists and occupational therapists to deliver the trial's integrated therapies in-person and/or via telehealth is currently underway. The trial will start in June 2022 and run for 18 months, utilising consult rooms and videoconferencing facilities at AITHM's Translational Research Facility.

In addition to Townsville, the UPLIFT trial includes investigators in Melbourne (University of Melbourne, Florey Institute of Neuroscience and Mental Health, Royal Melbourne Hospital, Austin Hospital), Brisbane (The University of Queensland, Surgical Treatment and Rehabilitation Service, Royal Brisbane and Women's Hospital, Perth (Edith Cowan University and Sir Charles Gairdner Hospital), and Adelaide (Royal Adelaide Hospital). The nation-wide trial is being led by JCU College of Healthcare Science Alumni, Dr Kate Hayward, who is now based at the University of Melbourne.





# Doctoral Cohort Program



*"Up to 70 per cent of Cohort Program candidates are working health and medical professionals, many tracking to leadership roles, and delivering high impact research outcomes." – Associate Professor Crowe.*

## Cohort Doctoral Studies Program gets gong for vision and leadership

The Australian Institute of Tropical Health and Medicine's Cohort Doctoral Studies Program, which supports and promotes research capacity-development amongst North Queensland's future health and medical researchers, has been recognised as an industry leader.

The Australian Council of Graduate Research awarded Associate Professor Melissa Crowe a Special Commendation for 'Excellence in Industry Engagement in Graduate Research' at its 2021 awards ceremony on April 29.

Australian Council of Graduate Research Executive Director Fiona Zammit said Associate Professor Crowe, who has led the Cohort Program for nearly 10 years, showed "vision and leadership of this outstanding program".

"Each year, winners are recognised for their personalised and adaptive approach to supervision and leadership across large and diverse academic units and their focus on engagement with industry on real world problems," Ms Zammit said.

"Melissa is recognised for her leadership of the Cohort Doctoral Studies Program in the Division of Tropical Health and Medicine, and how the program enables industry-relevant research ideas to be brought to fruition, with the potential for the outcomes to be translated into practice, changing patient care, and health policy."

The recognition comes as the Cohort Program celebrated its 10th Anniversary.

Under the guidance of Associate Professor Crowe, the Cohort Program, has become a thriving professional development program, supporting 145 Higher Degree Research candidates in 2021.

Associate Professor Crowe said Cohort candidates come with many years of experience from diverse backgrounds and discipline areas including working professionals in physiotherapy, exercise physiology, psychology, psychiatry, obstetrics, gynecology, emergency medicine, para-medicine, occupational therapy, dentistry, periodontics, social work, speech pathology, nursing and midwifery, mental health, pharmacy, pathology, infectious diseases, oncology, and gerontology.

Up to 70 per cent of Cohort Program candidates are working health and medical professionals, many tracking to leadership roles, delivering high impact research outcomes.

"These future researchers learn leadership through working successfully with advisory and stakeholder groups, in research design, research conduct and ethics, data management and analysis, and research communication. They benefit from wide professional networks and peer support generated within the Cohort community."

JCU Dean of Graduate Research Christine Bruce said the Program was a success in the way it was delivered, its low attrition rate, and the way it engaged industry.

"The Cohort Program will continue to be one of the important underlying structures to support the research activity within private and public health systems and other areas of industry, and to achieve its aim of graduating leaders in research, diagnostics, and excellence in tropical medicine," she said.



Associate Professor Melissa Crowe, Associate Professor Merryl Churchill, Dr Diana Mendez, Dr Karen Carlisle, Christine Teitzel and the 2022 Cohort.





## Telehealth pioneer: Connecting outback communities with cancer care

### *Professor Sabe Sabesan*

Townsville's leading medical oncologist and Australian Institute of Tropical Health and Medicine's (AITHM) member Professor Sabe Sabesan has not only pioneered telehealth models for cancer care, he has shone a light on the importance of scientific research for professionals looking to improve health outcomes for their patients.

Professor Sabesan is the Townsville Hospital and Health Service's Senior Medical Oncologist and Clinical Dean of the Townsville Medical Training Network.

He was also one of the first people to join the inaugural Cohort Doctoral Studies Program 10 years ago to learn about research methodology and frameworks.

Professor Sabesan has since informed state and national roll-outs of telehealth and teletrial models, influenced government policy, and he is the architect behind state and national telehealth policies and frameworks.

He said it all started with wanting to better support his patients, so he and hospital colleagues began using videoconferencing technology to conduct medical consultations and monitor patients' side effects from treatment.

"I was seeing firsthand the consequences of long-distance travel and relocation on rural patients," Professor Sabesan said.

"The launch of the Cohort Program was really good timing." It enabled us to examine our model of care while using research as a mechanism to develop the evidence base to demonstrate our impact."

Joining the inaugural Cohort in 2011, Professor Sabesan consolidated his work through his PhD project entitled 'Enhancing rural and regional access to service delivery using teleoncology models and

evaluating patient and staff experiences, safety and quality'. From there, the project rapidly gained momentum and broke new ground.

"Our North Queensland telechemo project was the world's first chemotherapy delivered via technology. No one had done anything like it," Professor Sabesan said.

"It's through this model that places like Thursday Island, Atherton, and Weipa, now all have chemotherapy closer to home."

Following the success of telechemo, Professor Sabesan looked to developing clinical teletrials, which has led to the development of the national framework – Australasian Teletrial Model under the auspices of the Clinical Oncology Society of Australia.

"Through the implementation of teletrials, regional patients now have access to cutting-edge medications that they didn't have before," Professor Sabesan said.

"These models have created a connected system, where patients have access to a suite of services and rural health professionals are formally part of a larger integrated system of clinicians."

Professor Sabesan said what he had learned through the Cohort Doctoral Studies Program had supported the progression of his work over the past 10 years, and the grounding in publishable research had proven the impact of the telehealth models and the benefit to society.

"For me, every publication is another lever to convince policymakers and colleagues of the benefits of these models. Without publication, your work lacks credibility. The Cohort Program gave us a methodology and a proven framework. The PhD process also strengthened different writing skills for me, which has led to me writing policy for the state government."



*"As leaders in the field of telehealth, we knew we needed to take a Centre of excellence approach to continue innovating and maximising our impact. Through this approach, we were able to influence government policies and inform state and national roll-outs of our telehealth models. If I'd just done all this work myself then it would stop here in Townsville and go no further."*





# A giant leap in diabetes foot disease research

*Dr Malindu Fernando*

Dr Malindu 'Mal' Fernando's research career began when he was accepted into the Cohort Doctoral Studies Program's second cohort intake. He is now an adjunct post-doctoral Research Fellow at JCU, and is making international connections to improve solutions for Australians with diabetes-related foot disease.

Trained in both podiatry and medicine, Dr Fernando is seeking better ways to help some of the more than 30,000 Australians who are admitted to hospital with diabetes-related foot disease each year.

Dr Fernando said many patients with diabetes-related foot disease were at high risk of limb loss, recurrence and death, but his research found an absence of effective secondary prevention programs.

"Providing a scalable alternative to acute hospital-based models of care for diabetes-related foot disease is of critical importance to the future viability of Australia's healthcare system, he said.

"Estimates show a well-resourced and effective prevention program could reduce diabetes-related foot disease complications by at least 20 per cent resulting each year in: approximately 6000 hospitalisations avoided; 1000 amputations prevented; \$400 million in healthcare costs saved; and 400 deaths avoided in Australia.

"I believe medical technology is a potential method by which these outcomes can be achieved for Australians living with diabetes-related foot disease, and I hope that collaborative work will lead to greater access to these technologies."

Dr Fernando obtained his PhD in the biomechanical evaluation of the diabetic foot, in 2017, under the supervision of JCU's Distinguished Professor Jonathan Golledge, AITHM member and Head of the Queensland Research Centre for Peripheral Vascular Disease, who continues to mentor Dr Fernando in his postdoctoral work.

Dr Fernando, a prestigious Fulbright Futures Scholar, is currently working with two renowned leaders in this medical field, Professor David Armstrong and Professor Bijan Najfi in the USA. Dr Fernando has authored more than thirty peer reviewed scientific publications related to diabetic foot disease, and two book chapters for which he was awarded national and international prizes.

Dr Fernando is currently a junior medical officer and conjoint lecturer at the University of Newcastle, but he has returned to his research roots at the JCU Cohort Doctoral Studies Program as a professional mentor to its Higher Degree Research students, offering peer review assistance, and providing talks on research methods and publications.

He said the Cohort Program is what really launched his academic career. "It provided me with a solid foundation including experienced mentors and a valuable peer network who I remain close to even today," he said.

"Over the years, I have learned that teamwork triumphs over individual achievement as it generates new ideas, new concepts, and leads to novel discoveries and approaches."

"The next stage of my academic career is focused on expanding international collaboration - specifically with our collaborators in Houston, Texas and Los Angeles, California."

Dr Fernando said the future of Australian clinical research was in multidisciplinary collaboration and in the sharing of resources to be able to achieve better, tangible outcomes, and in generating big data through collaborative work.

# Developing early test to predict cancer

*Ms Yomani Sarathkumara*

PhD candidate Yomani Sarathkumara is harnessing her knowledge of molecular immunology in a bid to develop an early diagnostic test that will one day predict cancers associated with infectious disease.

Yomani said if they could identify immune signatures in the blood of patients who are at risk of developing cancer, and predict them, they could potentially offer an early diagnosis to inform early intervention.

Yomani is particularly interested in Epstein-Barr virus (EBV), a member of the herpes virus family, which is known to be linked to a number of cancers.

"EBV is common throughout the world, and a very small fraction of EBV-infected individuals can develop an EBV-associated cancer. Most of these infectious disease-related cancers are often detected at the end stage of the cancer," she said.

"If we can predict the risk of an individual developing a cancer and we can get an early diagnosis, that might improve the prognosis for the patient, allowing them to get early treatment to stop the disease."

Yomani has spent the past two years at the Australian Institute of Tropical Health and Medicine (AITHM), undertaking protein microarrays on 1000 'blinded' samples from case-control studies as part of a collaborative study with the National Cancer Institute of the United States National Institutes of Health (NIH).

Her work aims to identify molecular immune signatures and pathogen proteins that represent potential biomarkers of underlying (latent) infection, to identify diagnostic immune signatures for EBV-associated cancers such as Natural Killer T-cell Lymphoma (NKTCL), Hodgkin's Lymphoma (HL), and Post-Transplant Lymphoproliferative Disease (PTLD).

Another aim of Yomani's PhD project is to reveal immune signatures of tuberculosis (TB) in a highly endemic rural community of Papua New Guinea, using whole-blood transcriptome profiling applying RNA sequencing techniques and machine learning approaches. The hope is that this work will provide a better understanding of the infection and disease categories, to help develop effective interventions and improve health.

Yomani said she has always been very dedicated to scientific research, which is 'all about exploring the unknown or when little is known, and identifying the knowledge and research gaps while understanding what we already know'. "This concept in research has motivated me throughout the journey so far," she said.

Her research began in Sri Lanka, where she completed a Master of Philosophy (MPhil) degree at the University of Peradeniya in 2018, working on zoonotic infectious diseases, including leptospirosis, hantavirus infection, and melioidosis.

She travelled to Australia and joined the JCU Cohort Doctoral Studies Program in 2019, working in AITHM under the guidance of Professor Denise Doolan.

"The Cohort is an excellent opportunity to make good connections, and provides excellent research mentoring," she said.

She encourages others who are passionate about becoming a researcher to understand the opportunities available, and choose a field of study of interest. Yomani has authored or co-authored eight publications in peer-reviewed international and local journals and is a highly ranked PhD student.





# Awards, Events, and 2021 Snapshot

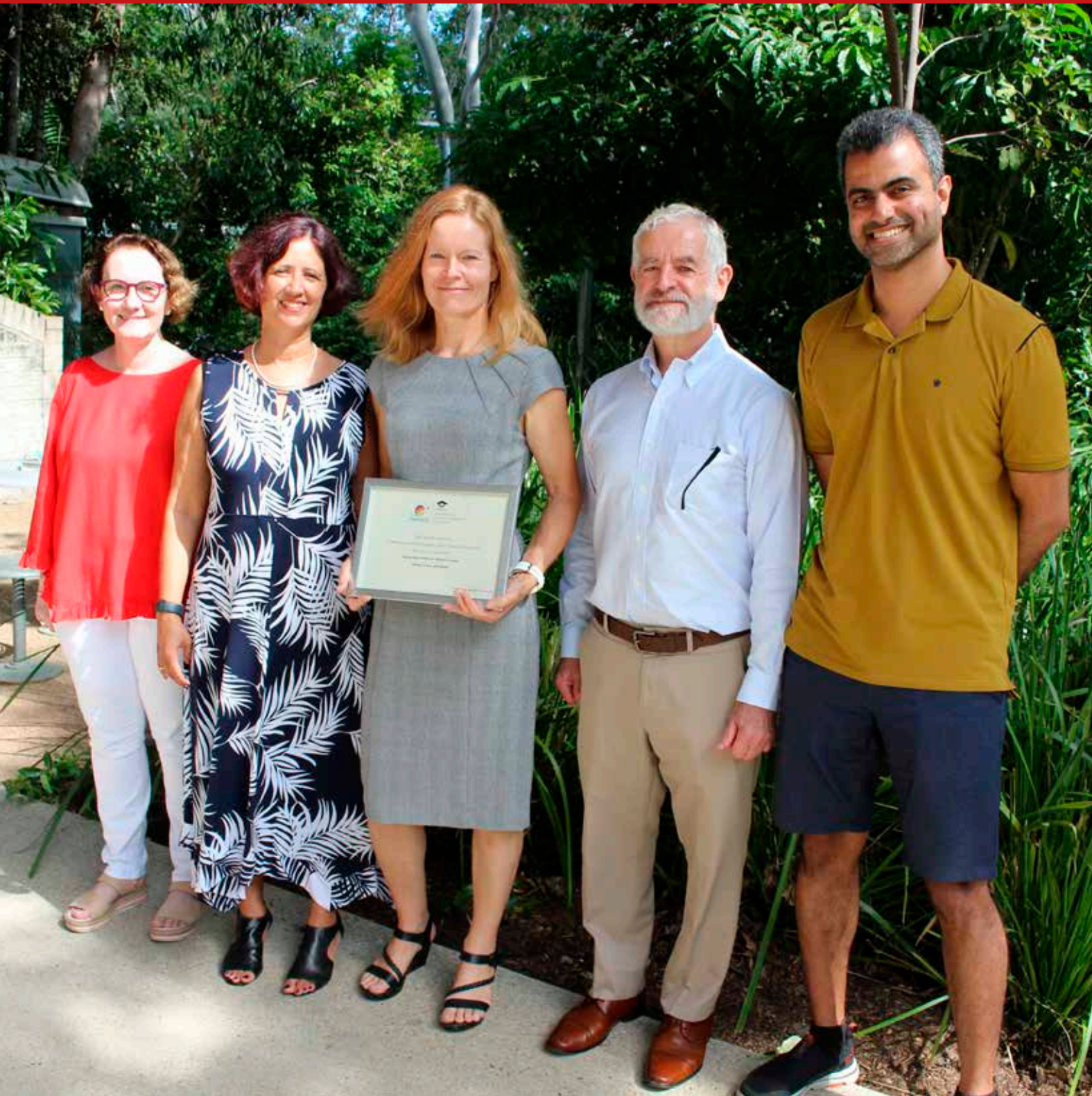


Photo (L to R) Dr Diana Mendez, Professor Christine Bruce, Associate Professor Melissa Crowe, Emeritus Professor Ian Wronski AO, Dr Sandip Kamath



Dr Hayley Letson

## Awards

### Associate Professor Melissa Crowe

Special Commendation for Excellence in Industry Engagement in Graduate Research 2021, from the Australian Council of Graduate Research.

### J'Belle Foster

Torres and Cape Hospital and Health Service (TCHHS) Continuous Quality Improvement Excellence Award 2021

### Professor Jonathan Golledge

2021 Fellow of the Australian Academy of Health and Medical Sciences

### Dr Allison Hempenstall

Torres and Cape Hospital and Health Service – James H Ware Award for Public Health Practice 2021, from Harvard T.H. Chan School of Public Health

### Dr Yaqoot Fatima

Queensland Young Tall Poppy Science Award 2021, from Australian Institute of Policy and Science

### Dr Margaret Jordan

The Australian Health Research Alliance (AHRA) Women's Health Research, Translation and Impact Network (WHRTN) Early and Mid-Career Research (EMCR) Funded Awards.

### Professor Sabina Knight, Order of Australia

Order of Australia (AM), Queen's Birthday Honours 2021, for significant service to rural and remote health, nursing and education.

### Professor Peter A. Leggat, AM, ADC

Australia Day Ambassador, National Australia Day Council and Queensland Government, 2021.  
Knight of the Order of St John.  
Honorary Member of the South African Society of Travel Medicine.

### Dr Hayley Letson

Queensland Young Tall Poppy Award 2021



# 2021 Snapshots

**\$8.299m**

Grant Funding

**116**

Employees

**223**

HDR Students

**655**

Members

**787**

Publications

**\$14,809,803**

invested in  
local community



## Chief Scientist Visits 5 May 2021



## Woman of vision honoured at ceremony

The Australian Institute of Tropical Health and Medicine (AITHM) dedicated a plaque to honour the legacy of Romina Fujii at its \$6.63 million research facility on Thursday Island in September 2021.

Admired and respected throughout the Zenadth Kes region, Romina Fuji was a driving force behind ensuring the culturally relevant and appropriate development of AITHM on Thursday Island.

Now known by the traditional name of Ngulaigau Mudh, which means "house of knowledge", the Thursday Island Campus supports both education and research into health issues of major concern in the Torres Strait region, including tuberculosis, diabetes, parasites and mosquitoes that transmit dengue and Zika.



AITHM Head of Operations Peter Westwood said: "Romina has left us with the challenge and the opportunity to maintain her vision and build upon her legacy".

*Aunty Romania Fujii's memorial plaque at AITHM's Thursday Island research facility*

## Professor Zoltan Sarnyai – Public Lecture – Brain Awareness Week



## AITHM State Government Breakfast



## Queensland Defence Science Alliance visits AITHM



## Emma McBryde – Covid-19 Modelling Short Course



## Prof Andreas Lopata and Shay Karnaneedi – Southern Cross School – Edible insects





## Advisory Board

### *Australian Institute of Tropical Health and Medicine Advisory Board*

The Advisory Board oversees the progress of the Australian Institute of Tropical Health and Medicine (AITHM) and advises the Institute on ways that it might develop its globally oriented research agenda. It 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 James Cook University. It meets three times a year.

#### Chair

**The Hon. Dr Michael Wooldridge**

*Independent Chair, Wooldridge Consulting*

#### Advisory Board members

- **The Hon. Jan McLucas**, Independent Board Director
- **Dr Julia Playford**, Executive Director for Science Strategy and Partnerships, Queensland Department of Environment and Science
- **Professor Zee Upton**, Pro Vice-Chancellor of the College of Health, Medicine and Wellbeing, The University of Newcastle
- **Mr Tony Wood**, Program Director, The Grattan Institute
- **Emeritus Professor Ian Wronski AO**, Chair, Tropical Australian Academic Health Centre
- **Professor Chris Cocklin**, Provost, James Cook University

#### Advisory Board ex-officio members

- **Professor Richard Murray**, Deputy Vice Chancellor, Division of Tropical Health and Medicine
- **Professor Louis Schofield**, Director, AITHM
- **Professor Denise Doolan**, Deputy Director, AITHM
- **Tina Chinery**, Chief Executive, Cairns and Hinterland Hospital and Health Service
- **Dr Kieran Keyes**, Chief Executive, Townsville Hospital and Health Service

## JCU Centres

The Australian Institute of Tropical Health and Medicine (AITHM) works closely with colleagues from James Cook University's (JCU) 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. Our 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 these priority health needs. We aim to progress health equity in partnership with Aboriginal and Torres Strait Islander peoples, rural and remote populations, tropical populations in neighbouring countries and other underserved groups.

### **Centre for Molecular Therapeutics (CMT)**

*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 diagnostics 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.

### **Murtupuni Centre for Rural and Remote Health (MCRRH)**

*Director: Professor Sabina Knight*

JCU's Murtupuni 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.

### **Centre for Tropical Bioinformatics and Molecular Biology (CTBMB)**

*Directors: Dr Matt Field, Dr Ira Cooke, Associate Professor Yvette Everingham*

This new research Centre, launched in October 2018, will analyse the massive amounts of data now being generated in biological science to help develop revolutionary techniques that could improve almost all aspects of modern life. The Centre will gather data generated by molecular techniques and then apply bioinformatics to analyse, visualise and interpret datasets involving many thousands of genes, genomic variants or microorganisms.

### **Queensland Research Centre for Peripheral Vascular Disease (QRC-PVD)**

*Director: Distinguished Professor Jonathan Golledge*

This Centre focuses 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.

### **Tropical Centre for Telehealth Practice and Research (TC-TPR)**

*Director: Professor Sabe Sabesan*

The Tropical Centre for Telehealth Practice and Research is the leading telehealth innovation and research organisation in North Queensland. Located within The Townsville Hospital and working closely with academic partners James Cook University and the Anton Breinl Centre for Health Service Strengthening (AITHM), the TC-TPR is dedicated to advancing telehealth practice, training and research across Northern Queensland and Australia, in order to provide quality and safe patient-centred care closer to home.







Australian Institute of Tropical Health and Medicine Research –  
taking a One Health approach at James Cook University.

*One Health recognises the interlinked relationship between the health of humans, animals, plants, the environment and ecosystems. The approach mobilises multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development - World Health Organization.*

## Contacts

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