ANNUAL REPORT 2024

AITHM | AUSTRALIAN INSTITUTE
OF TROPICAL HEALTH & MEDICINE

JAMES COOK UNIVERSITY
AUSTRALIA

Acknowledgements

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The AITHM acknowledges 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 respect to ancestors and Elders past, present and future.

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"Our work on parasitic hookworms as a clinical intervention has seen growing relevance in addressing inflammatory bowel disease (IBD) and diabetes — supported by numerous funding bodies and the biotech startup, Macrobiome Therapeutics."
— Director, Professor David Whitmore

Cape Tribulation

Director, Professor David Whitmore

Message From the Director

I would like to thank you for taking the time to read the 2024 Annual Report for the Australian Institute of Tropical Health and Medicine (AITHM). I hope that you find the stories shared here both insightful and inspiring, shedding light on the health impact that the work of our dedicated researchers, staff and students produces.

2024 marked a period of consolidation as we adapted to changes within James Cook University (JCU). Following a refinement of the University's strategic goals, the College of Public Health, Medical and Veterinary Sciences (CPHMVS) was integrated into the College of Science and Engineering (CSE) and the College of Medicine and Dentistry (CMD). AITHM's role in this new structure involves continuing to contribute to JCU's research efforts by fostering collaborations across these Academy boundaries, leveraging the expertise of our research staff and extensive infrastructure.

The theme of 2024 was undoubtedly the forging of new partnerships, and this focus will continue to strengthen as we move into 2025 and beyond. These collaborations will be both within JCU and more broadly across national and international networks. One major development of the year was the formation of the Don McManus Tropical Health Research Centre, led by QIMR Berghofer and officially opened on 27 September 2024 by Her Excellency the Honourable Dr Jeannette Young, The Governor of Queensland. As a founding member of this new collaborative centre, we are excited by this new opportunity to continue our work expanding tropical and infectious disease research across the state of Queensland.

Our vector-borne disease projects continue to move from strength-to-strength, particularly in the Pacific Islands and Papua New Guinea (PNG). The Department of Foreign Affairs and Trade (DFAT) extended its funding of our PacMOSSI project for a further five years, supporting the continuation of vital mosquito research and intervention in the Pacific Island Countries. Additional funded malaria projects are having a major impact in PNG through collaborative links with the Papua New Guinea Institute of Medical Research (PNG IMR). Moreover, our computational modelling efforts will hopefully play a big part in understanding and rolling out future plans for how to deal with vector-borne diseases in this area of the world. The importance of this work to our institute but also to the local communities cannot be overstated.

Another notable achievement for 2024 has been the progression of our tuberculosis (TB) vaccine development, with increased funding from The Bill and Melinda Gates Foundation. Our TB booster nano-vaccine has now been selected as one of the final candidates by the Tuberculosis Vaccine Initiative, which is a remarkable achievement for AITHM and JCU. Additionally, our ongoing work in intestinal immunology and toxicology, particularly marine toxins, continues to receive external support. Meanwhile, our work on parasitic hookworms as a clinical intervention has seen growing relevance in addressing inflammatory bowel disease (IBD) and diabetes — supported by numerous funding bodies and the biotech startup, Macrobiome Therapeutics.

2024 has seen major successes for all of our researchers, students and staff. Our position within the broader JCU structure has been consolidated and numerous new partnerships have been established. As we look ahead to 2025, AITHM is well-positioned for growth, with plans for new recruitment in key areas, joint appointments with partner institutions, greater use of our extensive infrastructure and increasing the impact of our work across the Tropics.

Professor David Whitmore
Director, Australian Institute of Tropical Health and Medicine

About AITHM

Established in 2013, the Australian Institute of Tropical Health and Medicine (AITHM) is a world-leading research institute focused on delivering health innovations tailored to the unique needs of the Tropics. Our Institute is committed to addressing the distinct health challenges faced by tropical communities, both within Australia and in neighbouring regions.

We strive to enhance health systems, improve healthcare delivery, bolster biosecurity and ultimately improve health outcomes in the Tropics.

With a multi-disciplinary approach, the Institute's research is organised around three core themes:

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

Tropical Health Security

Research under this theme is guided by a One Health approach, which recognises the interconnectedness of human, animal and environmental health around the globe. Our aim is to mitigate the risk of disease transmission in tropical communities and strengthen Australia's biosecurity. To achieve this, our research in this area focuses on:

- Vector control, such as mosquito and tick-borne diseases,
- Disease prevention, surveillance and containment,
- Pathology and epidemiology of zoonotic diseases (diseases transmitted between animals and people),
- Animal health, biodiversity and conservation. This includes animal nutrition, reproduction, disease risk, behaviour and wildlife conservation,
- Animal production and food security,
- Disaster preparedness and response,
- Collaborations with the Australian Defence Force.

Diseases of High Burden in the Tropics

Our research in this theme is centred around preventing and treating infectious and chronic diseases that disproportionately affect populations living in the Tropics. These include tuberculosis, dengue, malaria, allergies, parasitic worm infections, diabetes, mental illness, and inflammatory disorders. Our researchers are dedicated to exploring the therapeutic potential of our region's unique flora and fauna and improving the development of vaccines for these significant diseases.

Tropical Health Systems

The AITHM is committed to strengthening health systems in the Tropics, particularly in regional, rural and remote Aboriginal and Torres Strait Islander communities and in Australia's neighbouring tropical nations. Work under this theme includes:

- Capacity building within underserved healthcare systems,
- Health workforce development,
- Development, implementation and evaluation of healthcare delivery,
- Strengthening health system responses,
- Working with clinical partners to translate research findings into healthcare outcomes,
- Developing and deploying emerging health technologies such as artificial intelligence (AI) and telehealth.

Where We Work

The Australian Institute of Tropical Health and Medicine is based in Far North Queensland, Australia, with research partnerships worldwide.


Papua New Guinea
North America
Tropics
Thursday Island
Cairns
South Pacific Islands
South America
Townsville

2024 Snapshot

$6.77m
Grant Funding

61
Employees

670
Members

230
Higher Degree by Research (HDR) Students

509
Publications Produced

Over $11.8m
Annual expenditure
Much of which is invested in the local community

Infrastructure and Facilities

The Australian Institute of Tropical Health and Medicine (AITHM) state-of-the art research centres are based on James Cook University's (JCU) campuses in Townsville and Cairns. A third AITHM research centre and training facility is located on Thursday Island, close to Australia's nearest neighbour, Papua New Guinea (PNG).

Our research facilities in Cairns and Townsville include Physical Containment Level 2 and 3 (PC2 and PC3) laboratories, specialised spaces for small animal and invertebrate research, and biobank facilities for research into human diseases. Up to 80,000 biological samples can be stored at each facility in temperatures as low as -190°C.

The AITHM in Cairns is also equipped with a Tropical Medicine Mosquito Research Facility (TMMRF) and an EduQuarium. The mosquito facility simulates a natural environment and can house and produce large numbers of mosquitoes for various research programs, and the EduQuarium is designed for marine and freshwater research, including analysing the venom of animals such as stonefish and jellyfish.

Our Translational Research Facility (TRF) is based in Townsville and fitted with five clinic rooms used for clinical trials. The TRF is a space where clinicians and researchers can collaborate and meet the needs of patients, thus ensuring North Queensland-based medical trials can be conducted locally, and feed into local health care delivery.

The AITHM Clinical Research and Training Facility on Thursday Island is adjacent to the Torres Strait Hospital for better research, training and community engagement. This facility houses a PC2 laboratory and focuses on infectious diseases, such as tuberculosis and chronic diseases including diabetes and obesity, as well as mosquito and parasite research. Staff at the Thursday Island facility also work on projects of local importance identified by local clinicians.

2024 Partnership Highlights in South East Asia and the Pacific Island Countries

By collaborating with communities in South East Asia and the Pacific Islands, we transform our research into real-world outcomes for populations living in the Tropics.

Our researchers and their work in the Pacific Islands includes:

- Collecting samples from Indigenous children to understand the immune response to tuberculosis (TB) and Bacillus Calmette-Guérin (BCG) vaccinations in the Torres Strait.
- Using expertise in microbiology and immunology to focus on infectious diseases (including melioidosis and TB) predominantly in Papua New Guinea (PNG).
- Using mathematical models to guide decisions for TB control programs and evaluating projects using modelling insights into disease transmission in Kiribati.
- Conducting molecular and serological surveys to determine the burden and distribution of arboviruses and developing capacity for surveillance and laboratory detection of arboviruses in PNG and the Solomon Islands.
- Generating greater understanding of the circulation of methicillin-resistant Staphylococcus aureus (MRSA) and improving hospital-based diagnosis to better guide treatment options in PNG.
- Investigating the molecular epidemiology and environmental persistence of epidemic enteric pathogens in PNG.
- Using novel techniques of sample collection and analysis to conduct viral discovery in wildlife to assess the potential of zoonotic risk in PNG.
- Using mathematical modelling and artificial intelligence (AI)/machine learning-based approaches to enhance understanding of zoonotic spillover and inter-island transmission of mosquito-borne diseases (including dengue and vivax malaria) across the Pacific Island Countries.
- Mapping lymphatic filariasis and surveillance of malaria in PNG.
- Investigating the impacts of climate change on mosquito ecology in PNG.
- Monitoring mosquito insecticide resistance in PNG.
- Establishing surveillance strategies for Japanese encephalitis in PNG.
- Working with PacMOSSI to prevent current and emerging arboviral and parasitic diseases (dengue, chikungunya, Zika and malaria) transmitted by *Aedes* and anopheline mosquitoes throughout the Pacific Island Countries.
- Investigating the impact of climate change on brain health in Fiji, PNG, Samoa, the Solomon Islands, Tonga, the Cook Islands, Micronesia and the Marshall Islands.

Our researcher's partnerships in South East Asia involve:

- Developing anti-helminth subunit vaccines and diagnostics and treating inflammatory and metabolic diseases in Thailand.
- Investigating the emergence of avian influenza viruses in live bird markets in Cambodia.
- Using mathematical modelling and AI/machine learning-based approaches to enhance understanding of zoonotic spillover and emerging technologies for enhanced and scalable surveillance in Cambodia.
- Working to develop novel solutions to malaria in the Asia Pacific.
- Surveillance of zoonotic Plasmodium species and zoonotic malaria vectors in Indonesia.

Tropical Health Security

Ms Rebecca Vinit

Making home a safer place

Ms Rebecca Vinit and Associate Professor Stephan Karl

Malaria is a life-threatening disease that is spread to humans through the bite of infected mosquitoes. In 2022, it affected more than 249 million people around the globe — including Australia's closest neighbour, Papua New Guinea (PNG). New research indicates that people could be better protected from mosquito bites using a method that dates back to World War II, with a 21st century twist.

Malaria is primarily found in countries with a tropical climate, where people generally rely on the protection of mosquito nets that are treated with an insecticide. However, this leaves people vulnerable to bites when outside the nets.

PhD candidate Ms Rebecca Vinit, based at the PNG Institute of Medical Research and supervised by AITHM's Associate Professor Stephan Karl, is examining if indoor residual spraying (IRS) significantly reduces the number of malaria cases in PNG.

IRS involves spraying walls and other surfaces of the house with an insecticide. The insecticide will kill mosquitoes that land on these treated surfaces, and typically lasts for several months.

"IRS is not new to PNG; it was first used back in the 1930s and during World War II," Ms Vinit said. "After it became known that Australian soldiers were killed faster by malaria than in combat, indoor residual spraying proved to be very efficient in reducing the number of infections during the 1960s. But after PNG became independent in 1975, the program was abandoned."

Some insecticides that were used then were harmful to not just mosquitoes but also other animals. This is why in her research, Ms Vinit is using products that only affect mosquitoes. "We call it 'residual spraying' because it involves a small but potent quantity," she said. "It's enough to knock out a mosquito without having a negative effect on other animals or humans."

There are several mosquito species that can transmit malaria in PNG, and they may respond differently to insecticides. The actual mosquito population in a place depends on a variety of biological factors, such as how close to the coast a village is located.

Four villages along the North Coast of Madang Province in PNG participated in Ms Vinit's study: two located on the coast and two about five kilometres inland.

"In 2021, we initially sprayed two villages to assess the impact of indoor residual spraying. This was followed by monthly surveys before and after, as we wanted to find out how long the insecticide was effective," Ms Vinit said.

"In phase two, we sprayed all four villages and conducted two assessments to measure the effectiveness of the insecticide at three months and six months," she said. All in all, Ms Vinit's team sprayed around 330 homes in phase one.

"We have a hypothesis that indoor residual spraying is having a positive impact in our two inland villages, but in the coastal areas, where mosquitoes are more of a nuisance, it may be less effective," she said. However, the analysis is still in progress, and Ms Vinit said it's too early to provide any recommendations.

After Ms Vinit's research project is finished in 2026, indoor residual spraying may become part of PNG's national malaria control program to complement the current program of insecticide treated bednets. "Indoor residual spraying is an expensive intervention for the government," Ms Vinit said. "This is why I'm looking for an effective and efficient way to implement this in places where indoor spraying can actually make a difference."

Protecting small island nations against dengue

Professor Emma McBryde and Mr Mohabeer Teeluck

Mauritius

As the planet is heating up, dangerous mosquito-borne diseases such as dengue and chikungunya are spreading to more countries than ever before. This is especially problematic in small island nations with even smaller health budgets. Australian Institute of Tropical Health and Medicine (AITHM) researcher Professor Emma McBryde and PhD Candidate Mr Mohabeer Teeluck are developing software that helps predict future outbreaks.

Mr Teeluck, originally from Mauritius (population 1.3 million), has witnessed firsthand the growing threat of mosquito-borne diseases in his home country. "While diseases such as dengue are not endemic in Mauritius, we've had cyclic outbreaks of dengue every few years as well as some imported cases of other mosquito-borne diseases," he said.

"Post-COVID, Mauritius has recorded a surge in imported cases of mosquito-borne diseases such as lymphatic filariasis and chikungunya, and we are very concerned about the increasing risk of endemicity," he said. "The region also had a flooding event in January 2024. Soon after, we had more than 6,000 dengue cases for the first time."

In Mauritius, mosquito-borne diseases are primarily spread by the Asian tiger mosquito (***Aedes albopictus***) and the southern house mosquito (***Culex quinquefasciatus***). Mr Teeluck's research focuses on how environmental factors such as temperature, rainfall and humidity affect these mosquito populations. His previous research suggests that while higher rainfall and higher humidity can result in more mosquitoes and more dengue cases, the relationship is not always straightforward.

Professor McBryde said that there's a strong need for more information. "The findings of other studies we examined have been heavily weighted to just one country. We also found that the outcomes are not that easily predictable, and that it's important to have models like Mohabeer's that are bespoke for a specific country," she said.

For his research in Mauritius, Mr Teeluck said that the availability of reliable weather data is essential. "We have received access to free weather data from OpenWeather, under their Student and Healthcare Initiative programs, as well as the ERA5 data set," he said. ERA5 data is published by the European Centre for Medium-Range Weather Forecasts (ECMWF) and it provides hourly weather data from 1940 to the present.

Mr Teeluck said that not only the weather but also factors such as travel to and from the neighbouring islands and overseas, have an impact on the number of cases. The increasing urbanisation of Mauritius similarly has an impact on the spread of mosquito-borne diseases on the island. "The population is increasingly moving inland from the coast as the climate is cooler in the interior of the country," he said.

"We are going to use some machine learning for certain parts of the project, as well as semi-mechanistic and mechanistic models, where we draw on our knowledge about how these diseases spread, and put them inside a statistical model," Professor McBryde said.

"CIRAD, the French Agricultural Research Centre for International Development, is currently providing technical support to both the Public Health Unit of the Ministry of Health and Wellness and our French neighbours on the island of Reunion," Mr Teeluck said. "I'm very excited about this cooperation."

Once finished, Mr Teeluck's research aims to construct more accurate forecasts of future outbreaks of dengue and other mosquito-borne diseases in Mauritius. "This is why we are also using data from the 'Building Resilience in the Indian Ocean' (BRIO) project which produces future trends of temperature, rainfall and other data."

Mr Teeluck said that knowing when a future outbreak was expected would provide the government and community with more time to be better prepared.

He is planning to finish his PhD research by the beginning of 2027. "Once my research project is completed, we will be able to implement the outcomes in Mauritius, in collaboration with the Mauritius Ministry of Health and Wellness," he said. "I'm hopeful that this will have a positive impact on supporting the country's vector borne surveillance and preparedness activities."

PhD candidate Mr Mohabeer Teeluck

A healthy breeze

Ms Michelle Katusele and Associate Professor Stephan Karl

In Papua New Guinea (PNG), where more than one and a half million malaria cases emerged in 2022 alone, protection from mosquito bites is crucial to safeguarding health and wellbeing. In cooperation with the Australian Institute of Tropical Health and Medicine's (AITHM) Associate Professor Stephan Karl, PhD candidate Michelle Katusele is working to make life outside the mosquito net safer for people living in the Tropics.

As a researcher from PNG, Ms Katusele knows firsthand how mosquito-borne diseases impact the community. This is why, in her PhD, she's trialling 'spatial emanators' — small devices that release insect repellent into the air in selected households in PNG.

"The spatial emanators are made of a plastic frame and have a mesh in them that is treated with insecticide," Ms Katusele said. "The insecticide is released into the air, creating a nice protective space for people inside a house or in sheltered outdoor structures."

The chemical in the spatial emanator may deter a mosquito from feeding on a human. Depending on the insecticide used, spatial emanators can also kill or affect the reproductive system of a mosquito.

"With no need for electricity, relying only on air circulation, these devices could redefine how families in remote areas protect themselves. You simply hang it from the ceiling and forget about it," Ms Katusele said.

"When we conducted our first trials in October 2023, it was the first ever study on spatial emanators in PNG.

Field team sorting out spatial emanators at one of the selected study households

Ms Katusele (left) and onsite supervisor Dr Petrina Johnson (right) with a study participant calculating the number of devices to install.

"We are looking at the effectiveness of two devices. The first one, which we tested in 2023, lasts for up to a month," Ms Katusele said. "The one we are currently testing is actually a prototype, designed to last for more than a year."

For the study, two villages on the north coast of PNG near Madang with around 40 houses in total were equipped with spatial emanators. The exact number of devices per house depended on the number of rooms and the size of the rooms.

"In order to calculate how efficient the products are, we count the number of mosquitoes that land on our volunteers every hour," Ms Katusele said. "This method is called the 'human landing catch'. It is regarded as a gold standard to measure adult mosquito abundance, and in turn, it allows us to measure the efficiency of our devices."

While final results will come in 2025, early signs are encouraging, and Ms Katusele is optimistic that spatial emanators will make a difference in PNG.

"In our first trial we saw some really promising results, and we had really good protection rates inside buildings," Ms Katusele said. "The first device reduced the number of mosquitoes from biting people by 50 to 60 per cent. This is very promising, and we are very excited about this.

"In outdoor areas, we also see some potential for using the one-month product in future, but only for shorter periods of time," Ms Katusele said, adding that she was hoping to see better results for outdoor spaces in the current trial with the longer lasting emanator.

If successful, Ms Katusele's work could mean that families in PNG, and potentially communities across the Tropics, can enjoy safer spaces outside the mosquito net, decreasing malaria cases and contributing to a better quality of life.

A former Wellcome Trust M.Sc. fellowship recipient, Ms Katusele is one of the first PNG PhD students benefitting from a James Cook University-University of Papua New Guinea co-tutelle agreement allowing her to obtain a PhD from both institutions. She was recently offered a prestigious JCU PhD Scholarship to support her studies.

Associate Professor Tanya Russell at PacMOSSI's annual meeting in Samoa

Yellow fever mosquito (Aedes aegypti)

PacMOSSI: Empowering the Pacific to swat mosquito threats

Associate Professor Tanya Russell

In the fight against mosquito-borne diseases, countries in the Pacific Island region face unique challenges. These small, isolated nations are vulnerable to outbreaks that can overwhelm communities and health systems relying on limited resources. For this reason, the Pacific Mosquito Surveillance Strengthening for Impact (PacMOSSI) program was launched to support Pacific Island Countries as they work to combat these devastating diseases.

Led by Australian Institute of Tropical Health and Medicine (AITHM) researcher Associate Professor Tanya Russell, PacMOSSI is a collaborative initiative managed by James Cook University (JCU) in partnership with the World Health Organization (WHO) and The Pacific Community (also known as SPC). The program is a network of international institutions and Pacific Island Countries working together to monitor and control outbreaks of mosquito-borne diseases throughout the region.

"In small Pacific Island Countries, health systems are fragile, and capacity is very low," Associate Professor Russell said. "This means that when there are outbreaks of diseases like malaria, dengue, Zika or chikungunya, they can completely overwhelm the community and their resources. Our focus is on effective vector control to prevent transmission and save lives."

PacMOSSI was established in 2020 and has been focused on capacity building in 21 Pacific Island Countries ever since. The program offers online training and hands-on workshops that are tailored to each nation's needs, as well as equipment, supplies and operational research.

"The real strength of the PacMOSSI is in its development of networks and relationships, not only between the technical partners but also between the countries," Associate Professor Russell said. "Environmental health officers in this region are often juggling a large range of responsibilities and having that peer network allows them to share advice and support to make their operations more efficient."

PacMOSSI's work has been so impactful that it recently received an additional round of funding from the Australian Government Department of Foreign Affairs and Trade (DFAT), which will allow it to build on the successes of its first phase.

"It's really exciting to receive another round of support. This additional funding not only recognises the strength of PacMOSSI, but also highlights the ongoing need for the program from the country perspective," Associate Professor Russell said.

PacMOSSI plans to use the funds to expand its digital data management systems, engage communities in mosquito control efforts, and continue strengthening strategic plans for vector control.

"Moving forward, one area we want to focus on is supporting in-country vector control teams to encourage citizen science and develop interactive tools that encourage communities to participate in vector surveillance," she said.

"For example, a new module has been integrated into the high school curriculum in the Solomon Islands where students are learning about mosquito-borne disease transmission cycles. They're also learning how to build mosquito traps and collect data to submit to local health authorities.

"Building up that purpose of community by giving people a role and the ability to contribute to the greater good is hugely important."

Associate Professor Russell is confident that the PacMOSSI program is well-positioned to significantly enhance the capacity of countries in the Pacific Island region to monitor and control the persistent threat of mosquito-borne diseases.

"I really believe in PacMOSSI's ability to empower countries by developing tailored resources and programs to address their unique needs," she said. "Together, we can strengthen these initiatives and create a lasting impact on public health and quality of life in the Pacific."

Pacific Islands

Dengue drivers in Pacific Island Countries uncovered

Associate Professor Roslyn Hickson and Dr Justin Sexton

Dengue fever, a virus carried and spread by mosquitoes, has long been a public health concern for communities living in Pacific Island Countries — and cases are on the rise. New research explores how human movement and weather patterns influence outbreaks in this region.

The study was conducted collaboratively by researchers at the Australian Institute of Tropical Health and Medicine (AITHM) and the Pacific Mosquito Surveillance Strengthening for Impact (PacMOSSI) consortium. It was led by Associate Professor Roslyn Hickson and James Cook University (JCU) Adjunct Research Fellow and CSIRO Research Scientist Dr Justin Sexton.

"The number of dengue cases has been increasing over the last decade globally, but particularly in the Pacific Islands, to the point that it has gone from sporadic outbreaks to being endemic in several of the countries," Associate Professor Hickson said. "There's a lot of questions around what the drivers are for an outbreak starting and continuing to spread."

To better understand these drivers, the researchers analysed data on dengue, climate conditions and human movement from 19 Pacific Island Countries. This included information on international and regional travel, flight passenger numbers, mass gatherings such as sports events and international conferences, and meteorological data including temperature, rainfall, and solar radiation.

Dr Sexton and Associate Professor Hickson used machine learning algorithms to classify whether a given month marked the start or continuation of a dengue outbreak. The models identified which factors — such as travel or weather patterns — were most important in predicting outbreak dynamics.

"Our research suggests that human movement is one of the key factors in initiating dengue outbreaks in this region, but not their continuation," Dr Sexton said. "Outbreaks are often triggered by the arrival of an infectious person through international travel or travel between the Pacific Island Countries. However, once an outbreak is established, it doesn't necessarily need infected individuals continuously coming into the country to keep it spreading."

Instead, the results indicated that the ongoing presence of the disease and its continued spread largely depend on weather conditions.

Initially, researchers assumed that the increase in dengue cases was being driven by human movement alone, as many Pacific Island Countries experience relatively stable climates, making it difficult to discern the influence of weather patterns. However, the study found that climate plays a significant role in both the start and spread of outbreaks in this region.

"The most important factor for predicting a dengue outbreak was the average minimum temperature two months prior, whether it's the start of an outbreak or the continuation of one," Dr Sexton said. "We also found that rainfall and relative humidity were key factors, with the model identifying rainfall as having an impact on the start of outbreaks and humidity having an impact on their continuation."

Both researchers are optimistic that these findings will lay the groundwork for future research into the complex drivers of dengue outbreaks in this region.

"We hope that this research will guide thinking about future studies and give people an idea of where to look when they are building decision support tools," Dr Sexton said.

"Public health officials in Pacific Island Countries are already implementing prevention efforts around large events that attract thousands of people. We hope that this study provides a better understanding of how travel and climate intersect, and can help make those efforts more targeted," Associate Professor Hickson added. "For example, if significantly more visitors are expected during a certain period, it could prompt adjustments to surveillance levels or interventions based on weather patterns like increased rainfall or temperature fluctuations."

This research underscores the importance of a multi-faceted approach to controlling mosquito-borne disease outbreaks. By combining insights from both human movement and climate data, prevention and mitigation strategies can be more targeted to stop the spread of this growing threat.

Diseases of High Burden in the Tropics

More than a gut feeling

Dr Roland Ruscher

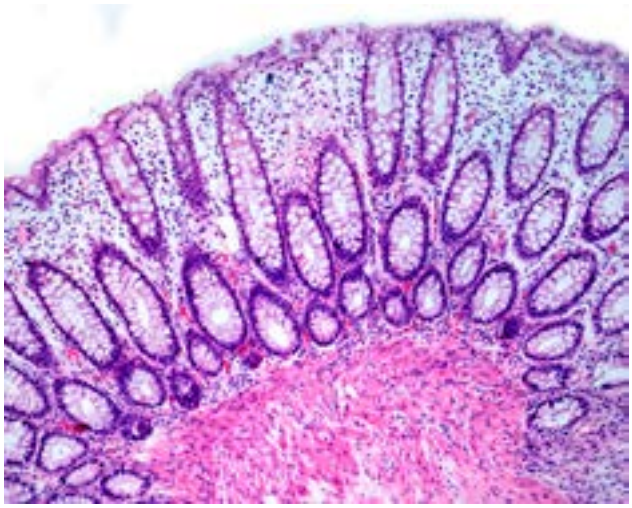
From left: Dr Shatarupa Das (Postdoctoral Research Fellow), Ms Sarah Gillert (PhD candidate), Ms Kim Miles (Research Assistant), Dr Roland Ruscher

Around 100,000 people in Australia suffer from Crohn's disease or ulcerative colitis; both conditions are more commonly known as inflammatory bowel disease (IBD). Aside from having a lower quality of life, people affected by IBD are also at an increased risk of developing colorectal cancer. Researchers at the Australian Institute of Tropical Health and Medicine (AITHM) are examining how gut immunity fails as people grow older, which is a first step to better treatments for people suffering from IBD and colorectal cancer.

So far, our knowledge about how the immune system in our gut changes over time remains limited. But AITHM's Dr Roland Ruscher aims to fill in the gaps with a 5-year project supported by a $600,000 National Health and Medical Research Council (NHMRC) Investigator Grant.

Dr Ruscher, Group Leader of the Mucosal Immunity Team and Head of Microbial Diversification and Translational Research Program, along with his PhD candidates Ms Maxine Smith and Ms Sarah Gillert, are working on this project.

"What we do know is that if you have colorectal cancer in your family, there's a bit of a genetic association with it," Dr Ruscher said. "But environmental factors throughout life and ageing processes also shape the intestinal immune system. We are wondering if there is something that you can do in earlier life to reduce your risk of developing colorectal cancer later on.



Microscopic image of a human colon

"Once we understand how early life events shape immune cells in the gut in the long run, it opens the door to developing specific medication or a vaccine to target those cells before IBD or cancer even occur."

In this context, Dr Ruscher is especially interested in intraepithelial lymphocytes (IELs). Lymphocytes are immune cells that identify threats and respond to them. IELs are specialised lymphocytes that live within the outer layer (epithelium) of the small and large intestine of mammals, where they help reduce inflammation and eliminate cancerous cells. "We now know that IELs develop in early life, and they are thought to persist as we age," Dr Ruscher said. "Events during infancy and childhood may therefore impact IEL functionality long-term."

Thanks to a collaboration with Yale University's Medical School, which provides access to donated gut cell samples from people of various ages, Dr Ruscher and the team have been given the opportunity to learn more about these elusive cells.

Often, immune cells can be maintained outside the body under cell culture conditions for some time. However, Dr Ruscher said a major challenge in this research project is that IEL cells die quickly once they are outside their usual environment, making experiments in culture conditions difficult.

"Other researchers have tried to keep these cells alive with limited success," he said. "But PhD candidate Maxine Smith has established a good protocol for maintaining IELs in culture for several weeks. This sets the stage for a lot of new studies."

However, gut cells are only one part of the equation. "Recently, we have also received a colorectal cancer cell line, and we can now culture these cancer cells in the petri dish along with IELs to study their cancer fighting capacity in-depth," Dr Ruscher said.

The research project finishes in 2026, and given the successes so far, the team is confident that they will continue to gain deeper insights into the connection between IELs, IBD and colorectal cancer by then. Their findings will pave the way for better treatments for patients suffering from IBD and colorectal cancer.

Peptide predictions with a high-tech twist

Professor Norelle Daly and Mr Tiziano Raffaelli

From agriculture and healthcare to business and education, artificial intelligence (AI) is transforming the future across almost every industry. But how might it be harnessed to shape scientific discovery? A new study from the Australian Institute of Tropical Health and Medicine (AITHM) explores AI's ability to predict the structure of peptides — a breakthrough that could accelerate the development of life-saving drugs.

The research focuses on cystine-rich peptides found in cone snail venom. These peptides have several disulfide bonds, which act as 'glue' to hold the peptide in a specific shape and stabilise their structure.

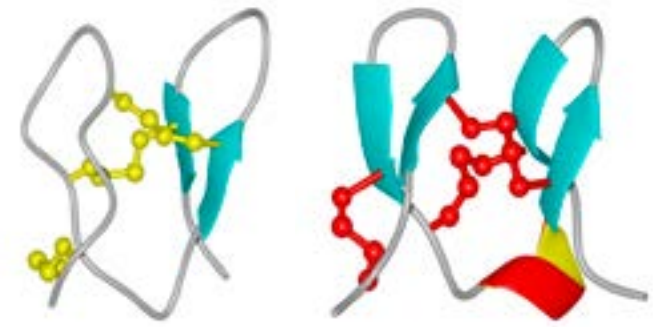
The way a peptide is structured is critical to its biological function, as it influences how the peptide interacts with its environment. For example, the structural constraints imposed by disulfide bonds in cone snail venom peptides can play a crucial role in the ability of the peptides to immobilise prey. Modifications in peptide structure can result in loss of function or unintended effects, so accurate structural prediction is vital.

In this study, AITHM Professor Norelle Daly, along with her PhD student and lead author Mr Tiziano Raffaelli, tested how accurately the AI tool AlphaFold could predict the structure of a specific cone snail venom peptide called TxVIIB.

"The AI successfully predicted the overall structure of the peptide but made errors in predicting the disulfide connectivity, leading to incorrect predictions about how these stabilising bonds are formed," Professor Daly said. "While models like AlphaFold have made significant strides in predicting larger protein structures, smaller peptides still present challenges."

According to Professor Daly, determining the structure of peptides is particularly challenging due to their small size and complex nature.

"At present, getting structures of peptides is extremely time consuming, costly, and requires specialised equipment and techniques such as crystallography and nuclear magnetic resonance (NMR) spectroscopy," she said.



NMR spectroscopy experimental calculation structure (left) and AlphaFold's predicted structure (right) for TxVIIB, a peptide found in cone snail venom

Textile Cone (Conus textile)

"If we can use AI to accurately predict these structures, it would accelerate the identification and development of novel therapeutics. Peptides, especially those with disulfide bonds, are key candidates for drug development because of their enhanced stability and ability to target particular receptors."

Despite current limitations, Professor Daly believes AI has enormous potential in structural biology, highlighted by the 2024 Nobel Prize in Chemistry awarded to Demis Hassabis and John Jumper for developing AlphaFold.

"AI for structure prediction is incredibly exciting and very promising," she said. "I believe it will continue to improve and play a significant role in the field. Although we're not yet at a stage where experimental structural biology can be fully replaced by predictions, studies like this one are crucial for shaping the future of AI predictions."

Indeed, as AI technology continues to evolve, it has the potential to revolutionise scientific discovery and transform the way we approach drug development. Professor Daly's team will continue to build on these initial studies to further explore the impact of AI on scientific discovery.

Boosting the power of the tuberculosis vaccine

Associate Professor Andreas Kupz and Dr Guangzu Zhao

AITHM's Kupz Group, including Associate Professor Andreas Kupz (centre back) and Dr Guangzu Zhao (far right)

The BCG vaccine (Bacillus Calmette-Guerin) has been the only available tuberculosis vaccine for more than a hundred years. The Australian Institute of Tropical Health and Medicine's (AITHM) Dr Guangzu Zhao and Associate Professor Andreas Kupz are now working on a new type of vaccine that aims to boost the power of BCG, as it currently only protects children and has limited efficacy against tuberculosis in adults.

"Australia has limited tuberculosis cases. Predominantly, because of our high living standards, good nutrition and small household sizes," Associate Professor Kupz said. "But the situation is quite different when it comes to Australia's nearest neighbours, Papua New Guinea (PNG) and Indonesia. These countries have some of the highest numbers of tuberculosis cases in the world."

Vaccinating children in less developed areas of these countries can be a difficult task, as the BCG vaccine has to be constantly refrigerated between 2°C and 8°C and needs to be kept away from sunlight. This can be difficult when no permanent power supply is available. However, for now, there are no alternatives to BCG.

"Tuberculosis is a complex disease, and we don't seem to be able to find a vaccine that is better than BCG," Associate Professor Kupz said. "Researchers have looked into the three possible vaccine types: the first one would be a preventative vaccine, that is, a replacement for BCG. The second type is a therapeutic vaccine, something that you would give to someone who already has tuberculosis.

"Our team is now working on the third type, on what we call a booster vaccine. For now, we think the best strategy is to make BCG even better by boosting the immune response BCG already elicits."

The booster project team is led by Associate Professor Kupz and Dr Guangzu Zhao. "I was brought on board for my specific expertise; Associate Professor Kupz is an immunologist and I am a biochemist," Dr Zhao said.

"Before I started working on this project three years ago, I had worked on a peptide-based vaccine against Group A streptococcus (GAS)," Dr Zhao said. "GAS is responsible for a variety of mild infections as well as life-threatening autoimmune diseases, such as rheumatic fever and rheumatic heart disease."

Now Dr Zhao is using the same technique in the fight against tuberculosis. "Peptides and peptide epitopes are the basis of our booster. Peptides are small pieces of proteins, whereas peptide epitopes are a certain fragment of protein that are recognised by the immune system," he said.

"Peptides alone are not able to induce a strong enough immune response. This is why our strategy is to prepare a vaccine using peptide epitopes and other peptide moieties (fragments)," Dr Zhao said. "When mixed into water, for example, our peptide vaccine can self-assemble spontaneously into nanoparticles. Nanoparticles are so small, they can only be seen in an electron microscope. This is why we are also calling our booster a 'nanovaccine.'

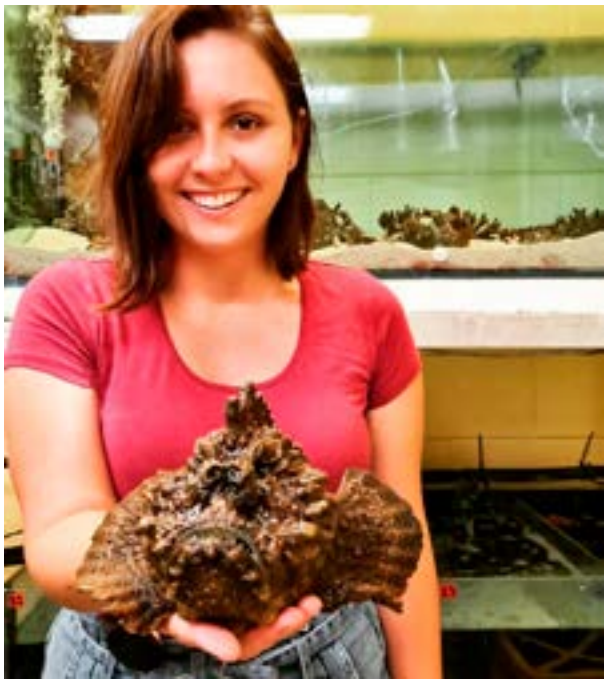
"The strength of our booster nanovaccine is its simplicity," Dr Zhao said. "Another advantage is that it is cold-chain independent. It doesn't have to be stored in a fridge or a freezer, it can be stored at room temperature."

"At the same time, it's flexible, it's a bit like a Lego system. Our nanovaccine is composed of six peptides, and each of the six peptides is one building block," Associate Professor Kupz said. "Depending on the population you are treating, the six peptides might be enough, or we may need a modified selection, or potentially include other peptides."

The AITHM's nanovaccine was recently selected for a global head-to-head comparison by the Tuberculosis Vaccine Initiative (TBVI). TBVI supports the development of new, safe and effective tuberculosis vaccines that are accessible and affordable for all people.

"Our booster is one of six candidates that were accepted in late 2024. TBVI will use an independent lab to compare all six vaccine candidates," Associate Professor Kupz said. "In our own trials, we have seen a good immune response, and we are confident that our nanovaccine will do very well in the TBVI trials as well."

If successful, the AITHM team's booster could become a game changer in the global fight against tuberculosis, offering new hope to millions of people worldwide.



Ms Danica Lennox-Bulow holding an estuarine stonefish (Synanceia horrida)

Stonefish skin toxins for parasite prevention

Ms Danica Lennox-Bulow and Professor Jamie Seymour

Parasitic worms infect about 1.5 billion people and millions of livestock around the world, causing a range of health problems and significant economic losses. With limited treatment options and growing drug resistance, tackling these infections has become increasingly challenging. But researchers at the Australian Institute of Tropical Health and Medicine (AITHM) may have discovered a solution in an unlikely source — the estuarine stonefish.

Stonefish (*Synanceia* spp.) are bottom-dwelling fish that camouflage themselves on the ocean floor to avoid predators and ambush prey. As the name suggests, they look and act like a stone. They are known as the world's most venomous fish due to the potency of their venom, which can cause a range of symptoms from severe pain to cardiac arrest, and in rare cases, death.

In addition to their venom, stonefish also release a toxin from their skin known as ichthyocrinotoxin, which, until recently, was largely unexplored. PhD candidate Danica Lennox-Bulow, under the guidance of AITHM's Professor Jamie Seymour, Dr Robert Courtney, Dr Michael Smout and Distinguished Professor Alex Loukas, set out to investigate whether the skin toxin from two different species of stonefish could treat parasite infections in humans and animals.

"While other species of fish that produce ichthyocrinotoxin, such as soap fish, use it to protect themselves against predators, we found that stonefish don't use it that way. Instead, when a stonefish feels threatened, they will raise the spines on their back to inject venom," Ms Lennox-Bulow said. "This suggests that the skin toxin might serve another purpose, which raised the question: if not to protect themselves from predators, what are stonefish using this toxin for?"

Based on their tendency to bury themselves in the mud and sand of the ocean floor, it's suspected that stonefish are highly vulnerable to skin-burrowing parasitic worms. However, despite this vulnerability, they appear to harbour a surprisingly low abundance and diversity of internal parasites. Ms Lennox-Bulow's research proposed that the stonefish's skin toxin may act as a defence mechanism against these organisms, a possibility that had not previously been explored.

"Understanding how this skin toxin works could reveal how stonefish protect themselves from parasites and offer new insights into potential treatments for worm infections in domestic animals, livestock and people," she said. So, Ms Lennox-Bulow tested if and how the skin toxin from reef (*Synanceia verrucosa*) and estuarine (*S. horrida*) stonefish affected skin-burrowing parasites.

"Our findings revealed that the toxin from the estuarine species of stonefish was slightly more harmful to parasites than the toxin from the reef species," she said. "But toxins are complex concoctions, and their composition can vary between species. So, our ultimate goal was to figure out what part of the toxin from each species was responsible for affecting the parasites.

From left: reef stonefish (Synanceia verrucosa) and estuarine stonefish (Synanceia horrida)

"To do this, I separated the toxins into two component groups (large components and small components) and tested each one. The large and small components from the reef stonefish, as well as the large components from the estuarine stonefish skin, had no effect. However, the small components from the estuarine stonefish skin toxin were found to be just as toxic to the parasites as the whole toxin."

This shows that small components are responsible for the toxicity in estuarine stonefish ichthyocrinotoxin, while both small and large components work together in reef stonefish ichthyocrinotoxin.

From a drug development standpoint, this makes the skin toxin from the estuarine stonefish more appealing than that from the reef stonefish. "Small components are generally easier to manufacture, more stable, and can be taken orally; that is, as a pill, for example," Ms Lennox-Bulow said.

The next stage of Ms Lennox-Bulow's research focused solely on the toxin from the estuarine stonefish. "After determining the effectiveness of the estuarine stonefish's ichthyocrinotoxin against parasites, we began to test if these components would be safe for humans by measuring their effect on cells in the lab," she said. "At concentrations that killed the parasites, these components were non-toxic to the majority of cell lines we tested. This suggests that some of the smaller components within the skin toxin of the estuarine stonefish may be promising candidates for anti-parasitic therapeutics."

Ms Lennox-Bulow, in collaboration with Professor Seymour and the AITHM team, plans to continue exploring the therapeutic potential of stonefish toxin for parasitic worm infections.

"While there is still a lot that needs to be done, this discovery holds promise for the future development of novel, nature-inspired therapies. It offers new hope in the fight against parasitic worm infections in livestock, domestic pets and humans, as well as the growing challenge of anti-parasitic drug resistance."

"Understanding how this skin toxin works could reveal how stonefish protect themselves from parasites and offer new insights into potential treatments for worm infections in domestic animals, livestock and people."
— Ms Danica Lennox-Bulow

From left: Dr Phurpa Wangchuk and Mr Gerry Turpin

Transforming ancient knowledge into novel treatments for inflammatory bowel disease (IBD)

Dr Phurpa Wangchuk and Mr Gerry Turpin

In collaboration with Traditional Owners from North Queensland, researchers from the Australian Institute of Tropical Health and Medicine (AITHM) have identified native plant compounds that could soon alleviate the symptoms of inflammatory bowel disease (IBD).

Dr Phurpa Wangchuk, AITHM Senior Research Fellow and James Cook University (JCU) Lecturer, has devoted his career to investigating how native plants from around the world are used in traditional healing. "We have been trying to document some of this ancient knowledge that is slowly being lost, not only in the West but around the world, as people are forgetting the benefits of traditional medicines," Dr Wangchuk said.

"Our goal is to document, protect and preserve this knowledge while also leveraging it to develop new medicines. That's where we, as researchers and chemists, play a crucial role."

Dr Wangchuk's research is funded by an Ideas Grant from the Australian Government's National Health and Medicine Research Council. The grant allowed Dr Wangchuk and his colleagues to test medicinal plants that could provide potential treatments for IBD.

People with IBD generally experience chronic inflammation in their digestive tract, which can result in abdominal pain and diarrhoea, and in some cases, colorectal cancer. IBD is a chronic disease that can't be cured. Patients are often prescribed corticosteroids or immunosuppressants, which can be harmful for the body.

As a fellow Chief Investigator, Mr Gerry Turpin from JCU's Australian Tropical Herbarium — who is also an Aboriginal Elder of Mbabaram Country west of the Atherton Tablelands over the Great Dividing Range — liaised with his community to document and preserve their valuable ethnomedical knowledge.

"I collected and identified plants, isolated molecules and examined whether they helped in alleviating IBD, all while being respectful with the communities, because it's their knowledge," Mr Turpin said. "I was able to identify almost 170 medicinal plants, and we preselected five promising candidates."

"Due to time constraints, we were only able to investigate three species. But we may look at other species at a later date," Dr Wangchuk said.

The team selected one Persoonia species (a small tree), one Corymbia species (a big gum tree, also known as 'bloodwood'), and one Tephrosia species, which is a perennial herb from the pea family.

"The active components in these plants were isolated by our postdoctoral chemists, Dr Matthew Perry, Dr Karma Yeshi and Dr Pornphimom Meesakul, as well as HDR student Mr Andres Ruiz Alvarez. We then tested the compounds' anti-inflammatory properties, in collaboration with the AITHM's Distinguished Professor Alex Loukas and Dr Roland Ruscher's team," Dr Wangchuk said.

During this process, the researchers discovered six novel molecules new to science and identified four compounds that looked like promising candidates for future IBD drug development. "We are discussing with our JCU commercialisation office to jointly — JCU and Mbabaram community — patent some of those promising novel drug lead molecules," Dr Wangchuk and Mr Turpin said.

Once the patents for these compounds have been filed, Dr Wangchuk is looking to found a startup and invite external investors to support the development of the potential IBD medications. Any financial returns will be shared with the communities that provided the traditional knowledge for this research, ensuring they benefit directly from it.

"No matter the outcome, this collaboration is already a success for the Traditional Owners," Dr Wangchuk said, "as their medical knowledge has been documented and will not be forgotten."

Hookworms: Unlikely heroes in the fight against autoimmune diseases

Distinguished Professor Alex Loukas and Dr Paul Giacomin

From left: Distinguished Professor Alex Loukas and Dr Paul Giacomin

For years, Distinguished Professor Alex Loukas from the Australian Institute of Tropical Health and Medicine (AITHM) has been hunting for a vaccine against hookworms, a parasitic infection that affects more than 740 million people worldwide. However, more recently, his research has found that these parasites might actually offer a benefit: certain proteins found in hookworm saliva could be used to treat inflammatory bowel disease (IBD) and other autoimmune diseases.

Hookworms are small parasitic worms that live in the soil in countries with a warm and humid climate. Hookworm larvae can break through human skin, and, attached to the walls of the small intestine of dogs, cats and humans, they can survive for years.

Many people who have been infected are feeding millions of hookworms, which leaves them permanently fatigued due to the constant blood loss. "The disease can be treated, but people can be quickly reinfected, sometimes within four to six months," Professor Loukas said. "This is why it's important that we find a vaccine."

However, there is also a positive side to the human-hookworm connection. "Hookworms are really potent at regulating and suppressing inflammation. They are doing this to protect their own existence and hide from our immune system," Professor Loukas said. "We are now trying to harness that phenomenon and develop an entirely novel approach inspired by nature to treating autoimmune diseases such as IBD."

Professor Loukas' colleague at James Cook University (JCU), Dr Paul Giacomin, led a clinical trial where people with metabolic syndrome (precursor to type 2 diabetes) were infected with up to 40 hookworms. Trial volunteers reported a better quality of life and improved insulin sensitivity compared to placebos who did not receive a worm infection.

Some volunteers have been living in partnership with their small band of hookworms for years. But Professor Loukas knows that not everyone enjoys the thought of permanently hosting hookworms in their gut. This is why he and Dr Giacomin are using their knowledge about hookworm proteins to develop novel medications via their startup biotech company, Macrobiome Therapeutics Pty Ltd.

"Our research has found that a single protein from our hookworms can prevent the onset of IBD and other inflammatory conditions such as rheumatoid arthritis," Professor Loukas said.

"We've got a handful of hookworm molecules that we engineer in the laboratory. They have all the right drug-like properties, and that is the reason we formed our company. We have selected two lead candidate molecules, and we're in the phase now that we would refer to as pre-clinical development.

"We have to create a version of our molecules to make them stay in the bloodstream for longer," Professor Loukas said. "We're currently trying to raise funding for this program. If that's successful, we go into clinical development to turn the molecules into a finished product. This is probably going to be a weekly or monthly injection, similar to the diabetes drug Ozempic."

A vaccine against hookworms is also still on Professor Loukas' agenda. "We are part of an EU-funded program that is developing vaccines for hookworm and blood fluke, with collaborators in the Netherlands, United Kingdom, Switzerland, Italy and Spain. By working in collaboration with researchers from around the world, we have a better chance of finally developing a vaccine that stops people from getting reinfected."

Microscopic image of a hookworm

From left: Professor Brian Cooke and Dr Vignesh Ambothi Rathinasamy

Protecting livestock and livelihoods with a dual-action vaccine

Professor Brian Cooke and Dr Vignesh Ambothi Rathinasamy

Cattle ticks are notorious for spreading tick fever, a potentially fatal disease that threatens the health of beef and dairy cows in Australia and around the world. The only currently available vaccine is expensive to produce, hard to deploy, and does not prevent the infected tick from transmitting the disease to other animals. Dr Vignesh Ambothi Rathinasamy and Adjunct Professor Brian Cooke are developing an alternative vaccine that aims to be more affordable, more effective and easier to deploy.

Cattle ticks transmit tick fever, also known as bovine babesiosis, in tropical and subtropical regions with high humidity, such as South and South East Asia, Sub-Saharan Africa, Central and South America, and most of Northern Australia.

"Tick fever can result in high mortality in cattle, but we don't actually know what the true economic impact is on the beef and dairy industry — it's potentially a lot worse than commonly known," Professor Cooke said. "It's very hard to get this data. We are now working with collaborators in the United States, Egypt and Türkiye to assess the global economic impact of cattle tick fever."

In Australia, a vaccine is available from the Tick Fever Centre in Brisbane for about six dollars per dose. The vaccines need to be stored and transported at 2–8°C and must be used within four days of manufacture. "If you are a beef farmer in the Northern Territory and you're running twenty or thirty thousand head of cattle, the cost adds up and will have an impact on the bottom line of the business," Professor Cooke said.

Cattle in Australia

"Our goal is to have not only a vaccine that protects the animals against disease, but that also cures the tick so it cannot transmit bovine babesiosis to other cattle."
— Professor Brian Cooke

Additionally, in some regions in Asia and Sub-Saharan Africa, subsistence farmers might only own one or two cows and often cannot afford the vaccine. Dr Rathinasamy, who grew up in South India, understands the challenges firsthand. "A family's livelihood may rely on that one animal," he said. "They might not be able to afford the vaccine, nor do they own a fridge to store it."

This is why Dr Rathinasamy and Professor Cooke are approaching the development of their tick vaccine from two key perspectives. "Our goal is to have not only a vaccine that protects the animals against disease, but that also cures the tick so it cannot transmit bovine babesiosis to other cattle," Professor Cooke said. "This is something that has never been done before."

The team have already conducted two successful large-animal trials with potential vaccine candidates in Queensland and in the United States. "One of the vaccines that we have co-developed with Dr Carlos Suarez from the United States Department of Agriculture has completely blocked the parasite circulation in the ticks," Dr Rathinasamy said.

"We are very excited about that, as it provides 100% protection. This could be turned into an effective vaccine as soon as we can find some investors to fund the venture."

The researchers are also seeing promising results in blocking the parasites in the cattle itself, but further work is needed before the vaccine candidate is market-ready. "It's showing strong signs towards protection, but we still need to fine-tune it to make it more effective," Dr Rathinasamy said.

Professor Cooke and Dr Rathinasamy are currently being supported by the Australian Research Council (ARC), which is funding their research into loopholes in the parasite's lifecycle that might be used as potential targets for new vaccines.

Additionally, funding from the Bill and Melinda Gates Foundation and the Canadian International Development Research Centre (IDRC) is expiring this year, leaving the researchers seeking new donors and investors.

Their work also includes a spin-off project that aims to reduce methane emissions produced by cattle — a promising extension of their current research.

Tropical Health Systems

Healing concussion with a 'big sniff'

Professor Geoffrey Dobson, Dr Hayley Letson and Dr Jodie Morris

Traumatic brain injuries can happen to anyone, anytime. People sustain head injuries from assaults, while playing sports, in car accidents, or on the battlefield. So far, there is no known cure, and severe brain injuries can lead to chronic injury and death. The Australian Institute of Tropical Health and Medicine's (AITHM) Professor Geoffrey Dobson and his team are working on a novel treatment that could speed up the healing process and prevent potential long-term consequences of a brain injury.

From mid-2021 to mid-2022, 17,700 people checked in at Australian Emergency Departments with traumatic brain injuries, including concussions. Of those, almost 11,000 had severe injuries and had to be hospitalised — for good reason. "Severe traumatic brain injury is a devastating injury with a mortality of around 25 to 30 per cent," Professor Dobson said. "At the same time, there is no drug therapy available to reduce mortality."

Just as the brain makes decisions about almost everything that happens in the body, an injured brain can become impaired from secondary injuries. This can have potentially severe consequences, such as acute inflammation and multiple organ dysfunction. Long term, moderate to severe brain injuries can also lead to dementia, stroke, post-traumatic stress disorder (PTSD) and a variety of chronic diseases.

"Imagine throwing a pebble into a pond. The pebble causes ripple effects in the water," Professor Dobson said. "There's not much you can do about the pebble hitting the water — comparable to the primary injury to the head. But what you can do is reduce the ripple effects or secondary injury progression."

Professor Dobson and his team, Dr Hayley Letson and Dr Jodie Morris, are looking to stop these secondary injuries from occurring by treating patients with ALM, a combination of three well-known drugs: Adenosine (A), Lidocaine (L) and Magnesium (M).

When combined in a single fluid, the team was surprised to find that ALM has different properties than each component on its own. This is why ALM is considered by the U.S. Food and Drug Administration (FDA) as a new drug.

ALM can help the body repair itself more quickly. This includes reducing internal bleeding after a severe injury, as well as preventing secondary injuries after a concussion. "ALM changes an injury phenotype into a healing one," Professor Dobson said. "And it does it pretty quickly."

The team is examining if ALM fluid therapy could serve as an alternative to the saline drip that is generally given to patients after an accident. Professor Dobson said patients would only need a fraction of the volume of saline solution that is usually given to a patient.

Professor Geoffrey Dobson and Dr Jodie Morris

"With the ultra-small volume of ALM protection, you're allowing the body to help itself, to recover and protect itself, using its own mechanisms," he said. "This way, the brain is being protected, and the heart is being protected."

Professor Dobson envisions that ALM could also be used as a nasal spray for mild injuries such as concussions. "You could just have a 'big sniff'. Inhaling ALM would bypass the blood-brain barrier, that very special membrane that we have in our brain that can prevent drug entry," he said. "This would help to get the ALM into the brain quickly and reduce secondary injury 'ripples' and its long-term chronic effects.

"The study we're doing at the moment is a prelude to human safety trials, and we are ready to test ALM in collaboration with military surgeons in San Antonio, Texas," Professor Dobson said. "Once the ALM has been produced in an FDA-certified facility, we'll start the safety trial."

Professor Dobson's team is currently receiving funding from the US Department of Defense, as internal injuries, bleeding and brain injuries are a regular occurrence on the battlefield.

"Having lightweight, effective treatments is a priority for medics on the battlefield but also for aeromedical retrieval services in rural and remote Australia," he said. "Whether you're in a local hospital, a remote region, or on the battlefield, ALM may be instrumental in prehospital care and preventing long-term chronic injuries in people who sustain traumatic brain injuries."

Model of the human head

A healthcare worker performing a nasal swab

Governance gaps: Navigating public health surveillance systems in the Tropics

Professor Stephanie Topp

Throughout history, we've seen a consistent pattern of infectious diseases emerge and re-emerge. This underscores the importance of ensuring our health systems are well-prepared and equipped with effective disease surveillance. New research from Professor Stephanie Topp seeks to determine how well disease control is being governed in Australia.

Public health surveillance refers to the collection and analysis of health-related data, including disease and health trends within populations. It is essential for detecting disease outbreaks and coordinating responses. Yet, the capacity for such surveillance varies widely between and within countries.

In Australia, public health surveillance — including data collection and emergency response — is primarily the responsibility of state, territory and local governments. But governance arrangements, which determine who has authority to make decisions, are not always clear. As exemplified by the COVID-19 pandemic, this can lead to contradictory messaging and inconsistent strategies to respond.

To better understand the strengths and weaknesses of current surveillance and response systems in Northern Queensland (NQ), Professor Topp and colleagues conducted case study research examining how different disease groups are governed in the region.

"Northern Queensland is an interesting zone for communicable disease control for a couple of reasons," Professor Topp said. "It's located within the Tropics, so it experiences higher rates of communicable disease outbreaks. It's the only region of Australia that has an international border, because of the proximity to Papua New Guinea. And it is a vast geographic area, positioned quite far from the policymaking centres of Brisbane and Canberra."

During the initial stages of the research, Professor Topp noted how the governance of different diseases varied. Consequently, she and the team chose to analyse the governance systems of four different disease groups: COVID-19, tuberculosis, sexually transmissible infections (STIs) and arboviruses.

"For each group of diseases, we looked at how decisions were being made and enacted in NQ," she said. "We asked: who is responsible for collecting and analysing communicable disease data? What are the organisational entities and decision chains that enable a response? What formal policies and informal practices guide the way the system functions?"

Over 18 months, Professor Topp and her team collected data by reviewing documents, observing organisational settings, and conducting over 80 interviews with public health staff, Queensland Health policymakers, National Aboriginal Community Controlled Health Organisation (NACCHO) leaders, and Hospital and Health Services (HHS) leaders.

The research found that the NQ surveillance and response systems for all four disease groups face at least three challenges in common.

First, weak coordination within and between sectors (for instance, between teams and organisations responsible for disease screening, data collation, analysis and strategic response). This means surveillance and response systems often rely on ad hoc communication and data-sharing arrangements, with unclear accountabilities when it comes to response. This leaves the systems prone to error or breakdown, especially in times of stress.

Second, a shift toward activity-based funding has reduced the resources available to maintain and adapt surveillance and response systems in the face of new or shifting threats, as was clear in the arbovirus surveillance section of the study and the 2022 outbreak of Japanese encephalitis.

Third, limited funds and a lack of priority during non-crisis times has left public health units short-staffed for all but the most basic functions, hindering their ability to respond to surges without undermining other essential services; this was particularly evident in the study's examination of the COVID-19 emergency.

Professor Topp hopes that these findings will be used to strengthen health systems for future pandemic preparedness and other public health crises.

"At a local level, I'd like these outcomes to stimulate conversations around the degree of priority and visibility that public health units have within Queensland's HHS. I'd like to see more discussions around how to ensure they are better positioned and resourced to conduct routine surveillance and to be capable of rapid response," she said.

"And at a state level, a conversation is needed around how to support and ensure HHS better deliver on their public health responsibilities. They do have legal responsibilities for public health functions, but currently the oversight of those responsibilities by the state government is pretty limited. I would like to see an investment in stronger mechanisms of accountability, including a more robust set of public health indicators that help track and support HHS performance in this area."

In striving for future preparedness, Professor Topp suggests policy makers in all jurisdictions do more to invest in disease prevention and promoting wellness.

"Unfortunately, decision makers in our health systems are often captive to electoral cycles and the curative care metrics associated with those cycles. And so, funding tends to follow instances of care, hospital bed availability and ramping rates; not the harder-to-quantify but more impactful population health strategies that could prevent or mitigate the next pandemic," Professor Topp said.

"But preventing ill health and promoting good health ought to be a key focus of all health systems. It is vastly more cost efficient and produces better outcomes."

"Northern Queensland is an interesting zone for communicable disease control for a couple of reasons. It's located within the Tropics, so it experiences higher rates of communicable disease outbreaks."
— Professor Stephanie Topp

Dr Shay Karnaneedi and Professor Andreas Lopata

Snacks made from the house cricket (Acheta domesticus)

Creepy crawly cuisine

Dr Shay Karnaneedi and Professor Andreas Lopata

From gardens to grocery aisles, edible insects are gaining popularity as a sustainable food source in the face of rising global demand. But could these protein-packed critters trigger unexpected allergic reactions?

Researchers from the Australian Institute of Tropical Health and Medicine (AITHM) and James Cook University's Tropical Futures Institute (TFI) investigated the allergenic potential of two approved edible insects: the house cricket *(Acheta domesticus)* and black soldier fly larvae *(Hermetia illucens)*.

To do this, Dr Shay Karnaneedi and Professor Andreas Lopata extracted proteins from commercial insect-based food products.

"Edible insects have been consumed for centuries in parts of Asia, Africa and South America. Now they're being introduced into mainstream markets in Western countries, but there is still a lot of stigma — and limited understanding of how they affect people with existing food allergies," Professor Lopata said.

"Insects are biologically related to crustaceans such as prawns and crabs, and crustacean allergy affects up to 4% of the population. This means people with shellfish allergies could be at risk of reacting to insect-based foods as well."

Currently, there are no food allergen detection methods for edible insects. Thus, existing testing relies on kits developed to detect crustacean allergens.

"We found that tropomyosin, the primary allergen in shellfish, was one of the most abundant proteins in cricket samples," Dr Karnaneedi said. "Interestingly, it wasn't as abundant in the black soldier fly larvae, which may be due to differences in life stage, with one being larvae and the other a fully developed insect."

However, the research did discover another shellfish allergen, hemocyanin, at high levels in the black soldier fly larvae. Both proteins were shown to react with antibodies from people allergic to shellfish, confirming their potential to cause cross-reactive allergic responses.

"We also found unique allergens in the insects, such as proteins that aren't known crustacean allergens. These proteins triggered a response from the immune system in people with crustacean allergy," Dr Karnaneedi said. "This suggests there may be other insect proteins that could pose a risk to those individuals. Current testing and labelling, which focuses only on known shellfish allergens, might miss these proteins."

The researchers also analysed two commercial crustacean allergen test kits to assess their effectiveness in detecting allergens in insect-based food products.

"Some of the test kits we looked at identified the allergens in moderate to high numbers, while others picked up no allergens at all," Dr Karnaneedi said. "This is a problem. If these food allergen test kits are not reliably identifying allergenic proteins, then food allergen labelling may not provide the necessary information for people with allergies."

In Australia, crustaceans are the number one cause of fatal anaphylaxis from food. There is no treatment or cure, so the only way to prevent a reaction is to avoid the allergenic foods.

"As insect-based foods become more common, we need better diagnostic tools to assess their safety for consumers," Professor Lopata said. "Insects are a nutritious and sustainable food source, and we want to ensure people can make informed decisions and stay safe."

Almonds are low in carbs and high in healthy fats, making them a good inclusion in a ketogenic diet

Food for thought

Professor Zoltan Sarnyai and Associate Professor Calogero Longhitano

Could the food we eat help alleviate mental health disorders? Professor Zoltan Sarnyai and Associate Professor Calogero Longhitano are testing how eating a metabolically balanced diet might help alleviate the symptoms of schizophrenia and bipolar disease.

Nutrition plays a key role in supporting our mental and physical health. Diets rich in whole foods such as fruits, vegetables, whole grains, lean protein and healthy fats have been shown to lower the risk of depression and anxiety. At the same time, poor dietary habits including high consumption of sugar, saturated fats and processed foods have been linked to increased inflammation and dysregulation of mood-related neurotransmitters.

"We are investigating the physical and psychological effects of two different diets on patients with severe psychotic disorders, including schizophrenia, schizoaffective disorder, or bipolar disorder," Associate Professor Longhitano said.

Over 50 volunteers from the Townsville University Hospital (TUH) are participating in the 14-week program, which has half of them switching to a modified ketogenic diet and the other half of the group following the recommendations of the Australian Guide to Healthy Eating (AGHE). The ketogenic diet, often referred to as 'keto', switches the body's primary energy source from glucose (sugar) to fat, entering a state known as ketosis.

"The ketogenic diet has a very high fat content with some protein and very low carbs. It can be animal in origin, but it can also be vegetarian. It often includes foods like avocado, olive oil and butter," Associate Professor Longhitano said. "Our senior dietician, Jaymee-Leigh Swift, provides comprehensive education and support to our volunteers, teaching them how to prepare their own keto meals. We want to ensure they can maintain the diet beyond the trial."

The study is funded by Roblox founders David and Jan Ellison Baszucki. The couple has been supporting mental health research projects after their son Matt, who has bipolar disorder, experienced positive outcomes when switching to a ketogenic diet.

According to Associate Professor Longhitano, preliminary results from the first 30 participants are promising. Both groups have shown improvements in psychiatric symptoms, metabolic health, and cardiovascular measures. Many also reported increased energy levels, reduced brain fog, and decreased depressive symptoms.

"We want to encourage our colleagues, our patients and the health community to consider metabolic therapy and lifestyle changes as essentially integral in the management of mental disorders, rather than simply an afterthought," he said.

The research team is continuing to recruit adult participants who live in the TUH catchment area and have had no major mental health episodes in the past three months.

Dr Chanika Alahakoon

Defusing the sweet time bomb

Dr Chanika Alahakoon and Professor Jonathan Golledge

Australians consume an average of 60 grams — or 14 teaspoons — of sugar per day. But, if you are a diabetic, too much sugar in your blood can lead to diabetic foot ulcers, foot amputations, and a higher mortality rate. For her PhD thesis, Dr Chanika Alahakoon from the Australian Institute of Tropical Health and Medicine (AITHM) worked with patients admitted to the Townsville University Hospital for diabetic foot ulcers with the aim to prevent future hospital readmissions.

Sugar is an important energy source for the body. But at the same time, too much sugar in the blood can cause severe damage. "When you have high levels of sugars, there's a process called 'glycation' that happens in your blood," Dr Alahakoon said. "This means that sugar attaches itself, for instance, to haemoglobin — the red colour pigment in your red blood cells — or to other proteins and cell membranes. This can lead to a variety of problems.

"In a healthy person, glycation of haemoglobin should be kept at less than six per cent. However, if you're diabetic, it is recommended to keep it under seven per cent," she said. "In those who have diabetic foot ulcers, we see nine or ten per cent persistently. This indicates that other protein substances are being subjected to the same glycation process."

People will often feel the effects of high blood sugar in their hands and feet first. "This sensory loss is known as the glove and stocking pattern," Dr Alahakoon said. "If people then sustain injuries, they don't feel the pain. When this happens repeatedly, people can get deformed feet or a 'diabetic foot', for example. This could be a little ulcer that just doesn't heal and can become infected because the white blood cells cannot get to the infection site."

For her PhD research, Dr Alahakoon and AITHM Distinguished Professor Jonathan Golledge worked with 190 patients who had been admitted to the Townsville University Hospital for diabetic foot disease. "The patients received the usual treatments such as antibiotics and treatments to restore blood flow," Dr Alahakoon said. Some patients were also fitted with a 'total contact casting', which is similar to a regular plaster cast. "A total contact casting distributes the pressure on the foot evenly and gives the ulcer time to heal."

Even though a total contact casting contributes to the healing process, foot ulcers will return if the patients don't change their diet and take better care of their feet. More than half of the patients in Dr Alahakoon's study were readmitted within 12 months. "The main reason for readmission was a subsequent diabetes-related foot problem," she said.

> ***"Sugar is an important energy source for the body. But at the same time, too much sugar in the blood can cause severe damage."***
> ***— Dr Chanika Alahakoon***

This is why Dr Alahakoon examined how recurrent diabetes-related foot ulcers could be prevented in the first place. "Patient education was favoured by other researchers because it does carry some weight if you tell patients, 'don't do this' and 'don't do that'," Dr Alahakoon said. "Regular GP visits are important, too. But overall, in our meta-analysis, we found that telling patients not to walk barefoot or not to wear thin-soled shoes or, generally, to take better care of their feet is not very effective," she said.

However, there are other methods to prevent foot ulcers. "We looked at foot temperature monitoring with an infrared thermometer, which patients can do at home," Dr Alahakoon said. "The studies we analysed show that it was easier to predict a foot ulcer in patients who measured their foot temperature every day."

Thermometers can show signs of inflammation, as an inflamed foot is indeed hotter than a foot that is not affected. "The idea was if you can measure the temperature, if you find it to be higher than the opposite leg and seek help from your podiatrist or doctor quickly, they will be able to help before things worsen."

Podiatrists can, among other things, measure the patient's foot and order custom-made shoes that perfectly fit the shape of the foot. "We call this 'offloading footwear,' as it evenly distributes pressure on the foot. It's just like a total contact casting, but definitely more comfortable," Dr Alahakoon said.

Dr Alahakoon was awarded a Medal for Excellence for her PhD thesis, Burden of Diabetes-Related Foot Disease in North Queensland, Australia, which was recognised as making a significant contribution to the future wellbeing of people suffering from diabetic foot disease.

Supported by a Medical Research Future Fund (MRFF) Cardiovascular Health Mission grant, Dr Alahakoon and Professor Golledge are now examining ways to prevent peripheral artery disease (reduced blood flow to the arms or legs) in diabetes patients.

Australians consume an average of 14 teaspoons of sugar per day

Our People
in positions of influence

Professor Tom Burkot
Fellow, American Society of Tropical Health and Medicine; Member, *Aedes albopictus* Torres Strait Programme Technical Advisory Group.

Dr Maru Castellanos
Consultant, PacMOSSI; Consultant, Entomological Network.

Professor Norelle Daly
Associate Editor, Toxicon; Company Secretary, Australian and New Zealand Magnetic Resonance Society.

Professor Denise Doolan
Member, Australian Government Medical Research Advisory Board; Elected Fellow, Australian Academy of Health and Medical Science; Elected Fellow, Queensland Academy of Arts and Sciences; Vice-President, International Society for Vaccines.

Dr Paul Giacomin
Associate Editor, Frontiers in Parasitology; Co-Director, Macrobiome Therapeutics; Academic Editor, PLOS Pathogens.

Professor Jonathan Golledge
Associate Editor, Atherosclerosis, Thrombosis and Vascular Biology; Steering Committee, Diabetes Feet Australia.

Professor Patricia Graves
Editor, Tropical Medicine and Infectious Disease.

Associate Professor Roslyn Hickson
Member, Pillar Working Group 3: ***Strengthen early warning systems to detect zoonotic risks***, Preventing Zoonotic Disease Emergence International; Member, Human Animal Spillover and Emerging Diseases Scanning Group; AITHM Representative, Deputy Vice Chancellor Research Advisory Group, James Cook University; Member, Invited Speakers Committee, Australian and New Zealand Industrial and Applied Mathematics; Chair, Queensland Branch, Australian and New Zealand Industrial and Applied Mathematics; Member, Expert Network, Human Animal Spillover and Emerging Diseases Scanning; Member, Operating Group, CSIRO-JCU Partnership; Member, Editorial Board, BMC Infectious Diseases; Assessor, European Science Foundation Grants.

Associate Professor Paul Horwood
Associate Editor, BioMed Central Infectious Diseases; Member, Steering Committee, CANARIES Network (The Consortium of Animal Market Networks to Assess Risk of Emerging Infectious Diseases Through Enhanced Surveillance); Member, Human Animal Spillover and Emerging Diseases Scanning; Member, Executive Committee, PNG Institute of Medical Research Buttressing Coalition.

Associate Professor Andreas Kupz
Advisory Council Member, Collaboration for TB Vaccine Discovery (CTVD), Bill & Melinda Gates Foundation; Co-Chair, Live Attenuated Research Community within CTVD; Queensland Committee Member, Australian and New Zealand Society for Immunology; Member, Organising Committee, Queensland Immunology Networking Symposium.

Professor Sarah Larkins
Member, National Health and Medical Research Council Research Committee (2022-2024 and 2025-2027 triennium); Convenor, Clinical Leadership Group, Tropical Australian Academic Health Centre (until Oct 2024); Member, Australian Health Research Alliance Council (collection of Australian Research Translation Centres (until mid 2024); Co-Director, Anton Breinl Research Centre for Health Systems Strengthening, Australian Institute of Tropical Health and Medicine; Member, Scientific Advisory Committee, National Health Medical Research Council Partnership Centre in Health System Sustainability; James Cook University Representative, Research Australia RoundTable; James Cook University Representative, Innovative Research Universities Health and Medical Subcommittee; Grant Reviewing, National Health and Medical Research Committee and Medical Research Future Fund; Panel Chair, Medical Research Future Fund; Chair, MRFF EMCR Fellowships Grant Review Panel; Panel Chair, QH Clinician Researcher Fellowships – Rural and remote novice researchers; Chair, NHMRC Targeted Call for Research Community Prioritisation Committee.

Dr Hayley Letson
Deputy Chair, Human Research Ethics Committee, James Cook University; Member, Editorial Board, Frontiers in Medicine; Member, Editorial Board, Rural and Remote Health Journals; Member, Editorial Board, Medicina; Review Panel Member, The Research Foundation Flanders (FWO), Belgium.

Distinguished Professor Alex Loukas
Chief Editor, Frontiers in Parasitology; Distinguished International Fellow, American Society of Tropical Medicine and Hygiene; Editorial Board Member, Expert Review of Vaccines; Fellow, Australian Society for Parasitology; Co-Deputy Director, AITHM; Co-Founder, Macrobiome Therapeutics.

Professor Emma McBryde
Member, Executive Committee for the Centre for Research Tuberculosis; Member, Executive Committee, Australian Consortium for Epidemic Forecasting & Analytics; Treasurer, Australasian Tuberculosis Forum; Senior Tuberculosis Clinician; Member, Tuberculosis Expert Advisory Group; Member, Health Issues Committee for the Torres Cape Hospital and Health Service.

Dr Diana Mendez
Higher Degree by Research Academic Mentor, Graduate Research School, James Cook University; Lead, Graduate Certificate and Diploma of Research Methods Committee, James Cook University; Course Coordinator, Graduate Certificate and Diploma of Research Methods Committee, James Cook University; Subject Coordinator, Research Methods Research Planning and Research Project (RM8301 and RM8302), James Cook University.

Associate Professor Joseph Moxon
Associate Dean, Research, College of Medicine & Dentistry, James Cook University; Director, Australian Atherosclerosis Society; Associate Editor, Editorial Board, BMC Cardiovascular Disorders; Associate Editor, Frontiers in Cardiovascular Medicine; Member, Queensland Cardiovascular Research Network.

Associate Professor Gunther Paul
Lieutenant-Colonel (R), Defence Attaché Service, Germany; Director, Aussie Ergonomics Pty Ltd; Editorial Board Member, Respiratory Physiology & Neurobiology; Editorial Board Member, International Journal of Industrial Ergonomics; Topic Editor, Symmetry; Founding Editor, MDPI Theoretical and Applied Ergonomics; Member, Standards Australia, Access for People with Disabilities; Member, International Advisory Board, Master of Science in Healthcare Systems Engineering, University of Central Florida; Ambassador for Australia, International Foundation for Professional Ergonomics.

Adjunct Professor Juergen Reichardt
Member, Medical Research Advisory Group, Australian Research Council; Member, Executive Board, Human Genome Organisation; Executive Associate Editor, Journal Human Genomics; Associate Editor, Board of Pharmacogenetics and Pharmacogenomics; Chair, Forum, Human Genome Organisation; Steering Committee, Global Genomic Medicine Collaborative; Guest Editor, Genetics and Genomics of Covid-19, Human Genomics; Guest Editor, Indigenous Health, Methods and Protocols; Guest Editor, Exploring Potential Drugs from Natural Products, Exploration of Drug Science; Board of Directors, ERCAL (Enfermedades Raras en América Latina y el Caribe); Co Chair, Human Genome Meeting (HGM2024), Rome, Italy; Co Chair, International Scientific Committee, Human Genome Meeting (HGM2024), Rome, Italy.

Associate Professor Tanya Russell
Committee Member, Guidelines Development Group for Malaria Vector Control, World Health Organization; Committee Member, Indo-Pacific Initiative Advisory Group, Innovative Vector Control Consortium; Co-Leader, PacMOSSI (Pacific Mosquito Surveillance Strengthening for Impact); Committee Member, Malaria Terminology Group, World Health Organization; Co-Lead, Roll Back Malaria Vector Control Working Group Task Team 2 of work stream 3 on capacity and collaboration.

Professor Zoltan Sarnyai
Adjunct Professorial Research Fellow, Tropical Futures Institute, James Cook University-Singapore; Co-Convenor, Oceania Hub, Connecting Climate Minds, a Wellcome Trust global climate change and mental health initiative; Member, Program Advisory Committee for "Metabolic Neuropsychiatry Conference", Ernst Strungmann Forum, 2024, Germany.

Professor Stephanie Topp
Board of Directors, Health Systems Global; Program Chair, 8th Global Symposium on Health System Research, Nagasaki, 2024; Honorary Principal Research Fellow, Nossal Institute for Global Health, University of Melbourne; Course Coordinator, Masters of Public Health-Masters of Global Development, James Cook University; Investigator (Fellow), National Health and Medical Research Council; Member, Expert Advisory Committee, NIHR-SHINE Project.

Professor Maxine Whittaker
Member, One Health High-Level Expert Advisory Panel, Quadripartite; Commissioner, People-Centred Care, The Lancet Global Health Commission; Chair, Communicable Disease Research Centre Reference Group, Fiji National University; Member, Biosecurity Queensland Ministerial Advisory Committee; Member, Partnerships for a Healthy Region Technical Reference Group, Australian Government Department of Foreign Affairs and Trade; Member, Independent Review Panel, Asia Pacific Observatory (APO) on Health Systems and Policies; Member, Advisory Council for the Centre to Impact AMR, Monash University; Civil Society Representative, Global Fund Greater Mekong Regional Artemisinin Initiative Regional Steering Committee; Senior Editor, CABI One Health; Editor, Malaria Journal; Editor, American Society of Tropical Health and Medicine Journal.

Professor David Whitmore
Director, Australian Institute of Tropical Health and Medicine.

Dr David Wilson
Treasurer, International Society on Toxinology.

Emeritus Professor Ian Wronski AO
Chair, Tropical Australian Academic Health Centre.

2024 Awards & Events

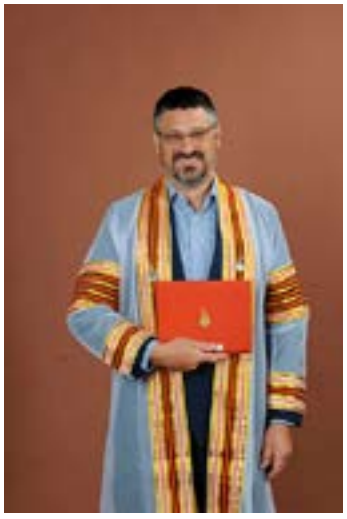
Awards

Professor Clare Heal and Dr Leanne Hall
Distinguished Paper Award, Australasian Association of Academic Primary

Distinguished Professor Alex Loukas
Honorary PhD in Tropical Medicine, Khon Kaen University, Thailand

Emeritus Professor Ian Wronski AO
Good Australian Award, Katter's Good Australian Awards

Dr Paul Giacomin
Finalist, Proto Axiom Challenger Summit



Distinguished Professor Alex Loukas with his Honorary PhD from Khon Kaen University

Events

NeuroSTEM Day

Longwood University Visit

STEM Like A Pats Girl

Japanese Ministry of Defense Acquisition, Technology and Logistics Agency Visit

Newman Catholic College Visit

Defence Science and Technology Group Visit

James Cook University Open Day

JCU Centres

The Australian Institute of Tropical Health and Medicine (AITHM) works closely with a number of James Cook University's (JCU) health research centres.

Centre for Tropical Biosecurity

The Centre for Tropical Biosecurity aims to reduce biosecurity threats and impacts in the tropics and beyond by applying JCU's biosecurity-related research and research training expertise. Detecting, understanding, and responding to biosecurity threats are among the universal challenges in biosecurity, and the Centre brings together expertise from across the University to address these challenges under six main research themes: Invasive Species, Ecology and Management, Quantitative Approaches, Production Systems, Social and Systems Biosecurity, Tools and Technology, and Zoonoses and Emerging Diseases.

Anton Breinl Research Centre for Health Systems Strengthening (ABRCHSS)

The ABRCHSS 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. The Centre focuses on meeting priority health needs through research that makes a difference, and training a workforce with the knowledge, skills and attitudes to respond to these priority health needs. Their aim is to progress health equity in partnership with Aboriginal peoples and Torres Strait Islanders, rural and remote populations, tropical populations in neighbouring countries and other underserved groups.

Murtupuni Centre for Rural and Remote Health (MCRRH)

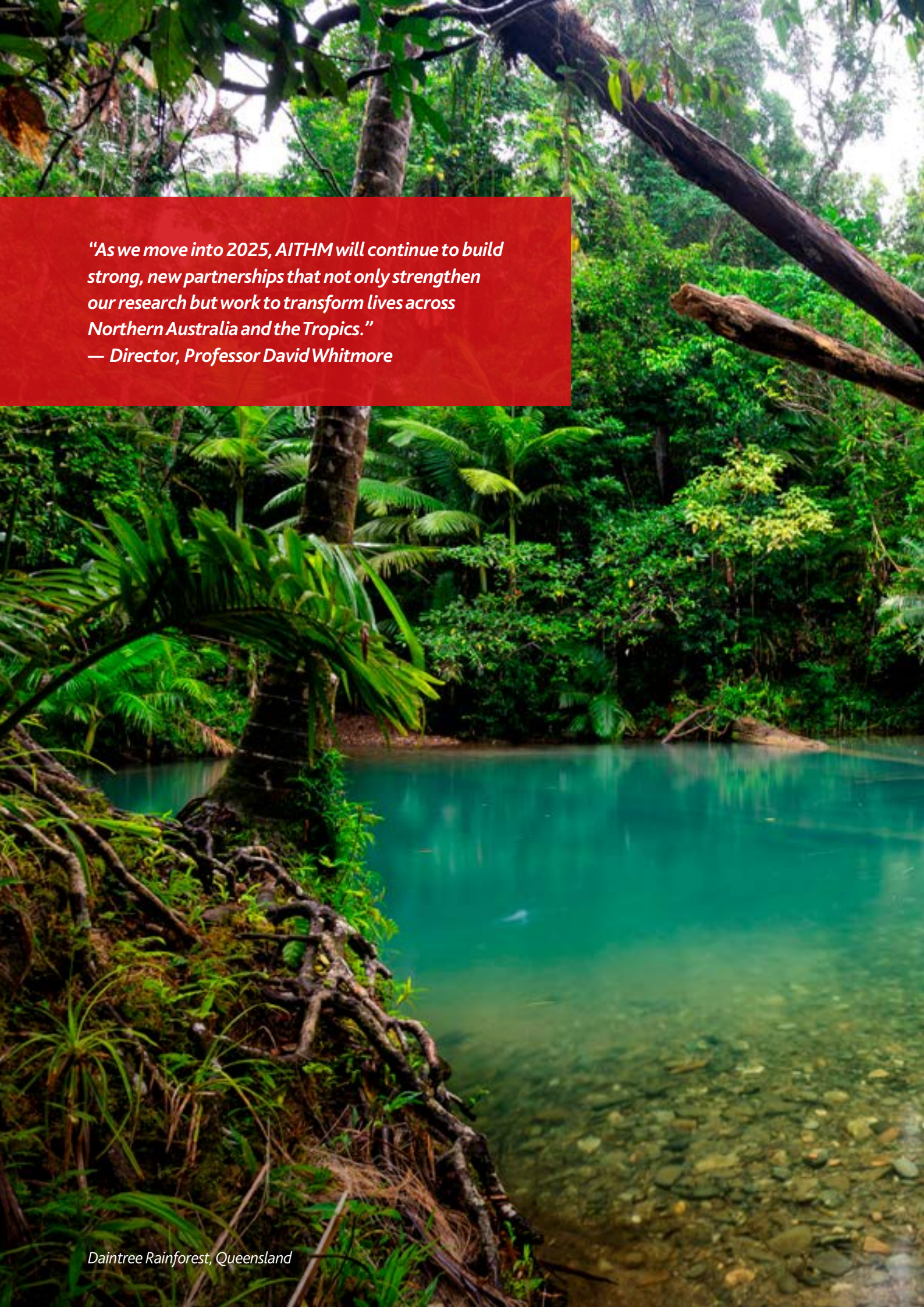
The MCRHH, headquartered in Mount Isa, has a mission of leading excellence in remote, rural and Indigenous health research. The group undertakes research relevant to health workforce and health in outback Queensland. Key research areas include rural health workforce development, rural health improvement, rural health services improvement, and innovation — developing new models of care to achieve better health outcomes.

Centre for Tropical Bioinformatics and Molecular Biology (CTBMB)

The CTBMB develops innovative solutions for the Tropics using high throughput molecular data and cutting-edge bioinformatics. Their research spans tropical health, biodiversity, aquaculture, biosecurity and agriculture, and aims to improve clinical care, food production, and environmental management. The Centre gathers data generated by molecular techniques and then applies bioinformatics to analyse, visualise and interpret data sets involving many thousands of genes, genomic variants or microorganisms.

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

The QRC-PVD is focused on improving understanding and management of peripheral vascular diseases (PVDs). Their research includes pre-clinical work designed to identify treatment targets and risk predictors for PVD patients, studies aimed at better understanding mechanisms involved in PVD development, and clinical trials designed to identify or test therapies for PVD. The Centre uses a broad range of techniques including vivo preclinical models, in vitro studies, genomics, genetics, bioinformatics, molecular biology, epidemiology, clinical trials, health economics and complex statistical analyses.



"As we move into 2025, AITHM will continue to build strong, new partnerships that not only strengthen our research but work to transform lives across Northern Australia and the Tropics."
— Director, Professor David Whitmore

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