Dr Amy Cosby is part of a team of agriculture researchers who are working hard at making a difference in rural communities by building capacity of the next generation of agricultural workers and addressing the challenges affecting farmers and their businesses.
CQUniversity is emerging as one of Australia’s great research universities.

Its success is largely due to its determination to meet the needs of the communities it serves. After more than half a century working with stakeholders in regional Australia, CQUniversity has emerged as a research powerhouse, committed to engaging and collaborating with communities and industry to achieve real-world research outcomes in our regions and beyond.

The University has a strong ethos of doing things differently, which is reflected in its research initiatives. With an applied research focus, CQUniversity aims to achieve real impact for its communities and stakeholders, with a vision to be one of the top applied research institutions in the country.

We aim to achieve complete relevance in our research efforts through strong links with industry, government and communities, as well as through close collaboration with national and international researchers and research networks. From agriculture to health, our research institutes and centres facilitate activity that involves our stakeholders and in turn makes a tangible impact to end-users.

As the only university in Australia with a physical presence across every mainland state, CQUniversity is uniquely positioned to establish and maintain networks and partnerships across the length and breadth of the country. This incredible power of place allows the University to engage deeply, thoroughly understand, and focus on the issues that matter to those we seek to support.

As a university with a strong engagement focus, CQUniversity is committed to conducting research that is innovative, creates impact, and drives positive change for the regions we operate in.

By working collaboratively with the communities and industries we serve, some remarkable feats are being achieved across a range of research fields.

At CQUniversity we place a focus on research that will deliver solutions to complex challenges. In particular, we focus on research on regional development, growth in resource industries, environmental management, healthcare and health promotion in regional and remote communities, social and human development, and equity and education delivery.

CQUniversity has around 480 research higher degree students and around 180 research projects currently underway, from research impacting the Great Barrier Reef and Australian water quality through to the well-being of FIFO workers and those facing homelessness.

This engaged research agenda is vitally important because, more so than ever before, universities have a crucial role to play in influencing the growth, success and prosperity of Australia. They also have a specific responsibility to find innovative, sustainable, and accessible solutions to the complex economic, social, and environmental challenges currently impacting the world around us.

Working with end users to understand problems and uncover solutions sets CQUniversity apart when it comes to the delivery of real-world research. This will continue to influence our research philosophy, guiding our researchers to deliver outcomes that truly make a difference and improve the quality of life for those living in our communities.
Thanks to the research efforts of Professor Kerry Walsh, CQUniversity has built the world’s first mango auto-harvester. The prototype has received overwhelmingly positive feedback within the industry.
CQUniversity Australia has been on a phenomenal trajectory in recent years. Its remarkable growth in student numbers, new courses, new campuses, infrastructure and reputation has seen it emerge as one of Australia’s truly great universities.

Originally founded in Rockhampton in 1967 as the Queensland Institute of Technology (QIT) Capricornia, it was granted full university status in 1992 and was named Central Queensland University. It now has more than 35 000 students and has firmly established itself as one of the largest universities based in regional Australia, with campuses in Adelaide, Brisbane, Bundaberg, Cairns, Emerald, Gladstone, Mackay, Melbourne, Noosa, Perth, Rockhampton, Sydney and Townsville. Along with these campuses, the University also operates study centres in Biloela, Broome, Busselton, Charters Towers, and Yeppoon, and delivers courses in Berri, Cooma, Geraldton, Goulburn, Karratha, Murray Bridge, Port Augusta and Port Pirie thanks to partnerships with the regional university centres in those communities.

In 2014, the University merged with CQ TAFE, bringing together more than 175 years of combined experience in the delivery of education and training and establishing Queensland’s first comprehensive, dual sector university. As a result, CQUniversity now delivers more than 300 education and training offerings, from short courses and certificates, through to undergraduate, postgraduate and research degrees. Study areas include apprenticeships, trades and training, business, accounting and law, creative, performing and visual arts, education and humanities, engineering and built environment, health, information technology and digital media, psychology, social work and community services, science and environment, and English, study and work preparation. As a pioneer in the delivery of distance education, CQUniversity also continues to be a leader in this area with almost half of the current student cohort made up of students studying off campus, many of whom are based in rural and remote areas.

With a legacy of working with a range of stakeholders in regional Australia, CQUniversity is now a renowned research institution in several key disciplines, and the benchmark leader for how universities should engage and collaborate with communities and industry. Its applied research focus is oriented towards real-world outcomes, with the purpose of providing solutions to challenges and identifying new opportunities for advancement in our regions and beyond. This research focus has seen CQUniversity achieve Excellence in Research Australia (ERA) results of ‘above’ or ‘well above’ world standard in 13 categories of research including Mathematical Sciences, Applied Mathematics, Horticultural Production, Engineering, Psychological and Cognitive Sciences, Psychology, Agriculture and Vet Sciences, Agricultural, Land and Farm Management, Public Health and Health Services and Nursing.

CQUniversity is proud to be recognised as Australia’s most inclusive university with the highest ratio of students from disadvantaged, mature-age, Aboriginal and Torres Strait Islander, and first-in-family backgrounds. This inclusive approach and commitment to access and participation means the University defines itself by who it embraces, rather than who it excludes.

Graduates from CQUniversity also have some of the best employment outcomes in Australia, with recent data released by the Graduate Outcomes Survey indicating that 79.5 per cent of domestic undergraduate students find full-time employment within four months of graduation, compared to the national average of 72.3 per cent. CQUniversity also ranked second in Australia for median postgraduate starting salaries.
and was awarded a five-star rating by The Good Universities Guide 2020. The Guide also ranked CQUniversity in the top universities for postgraduate skills development.

CQUniversity also places a strong emphasis on social innovation and global outreach and fosters a number of key partnerships with communities, industry and government, both in Australia and overseas. This commitment to engagement and social advancement has led to CQUniversity being recognised as Australia’s first and only Changemaker Campus by Ashoka U, an exclusive global social innovation group made up of only 40 other education institutions across the world, driving initiatives that help to overcome social disadvantage, by working with stakeholders to develop solutions for whole of community.

CQUniversity’s unique vision for diversity, outreach, engagement, research, learning and teaching, and inclusiveness, combined with its growth aspirations and continued expansion of student success, research excellence, social innovation and community engagement, has led to it being recognised within the top 800 universities in the world by the prestigious Times Higher Education World Rankings, and among the world’s top ‘young universities’ by both Times Higher Education and the QS World University Rankings.

CQUniversity’s applied research focus emphasises the translation and uptake of research findings to meet stakeholder’s real-world needs. As one of Australia’s most engaged universities with an emphasis on globally relevant activity that benefits the regions we serve, CQUniversity is fast becoming one of the nation’s most respected applied research institutions.
RESEARCH AT A GLANCE

RESEARCH IMPACT
CQU’s research focus and engaged research agenda are already making positive impacts on individuals, communities and industries across the world. In coming years, this impact will continue to grow, expanding into new focus areas and transforming the way we think about current challenges.

The University’s research impact is apparent in improved industry processes, regional and economic development, business improvement, productivity and innovation, social advancement and equity and healthier communities.

ENGAGED RESEARCH
CQU’s research agenda is built around deep engagement with communities, industries and government. The focus is firmly placed on the delivery of research that is primarily relevant to the Northern Australia region. To deliver great research that is meaningful and relevant, researchers work directly with stakeholders to identify challenges and deliver solutions. The end user is involved throughout the entire research project. This approach ensures CQU’s research delivers direct benefit and long-lasting impact.

SOCIAL INNOVATION
CQU is officially recognised as Australia’s only Changemaker Campus by global social innovation group Ashoka U. The University achieved this reputation because of its strong engagement agenda and inclusive approach to the delivery of research, education and training.

Social innovation is about working with communities in a collaborative way, using a range of strategies, to find innovative and sustainable solutions to social needs or problems. Ultimately, the philosophy is driven by the simple need to improve lives and create positive change within the world around us.

CQU is at the core of the University’s strategic vision and for many years has been entrenched in its core values. This approach sets CQU’s research apart, as it means end users are involved in the research process, and research success is measured by the visible impact it is having on the communities and industries the University seeks to help.

RESEARCH AT A GLANCE

396 active researchers

480 research higher degree students

$14+ m in external funding in 2019

180 research projects

$70+ m in competitive research income 2010 – 2019

650+ annual peer reviewed research publications

2 research institutes

7 research centres

14+ m in external funding in 2019

70+ m in competitive research income 2010 – 2019

650+ annual peer reviewed research publications
LEARNING AND TEACHING INFORMED BY RESEARCH

The research conducted at CQUniversity helps to guide the design and delivery of learning and teaching. CQUniversity strives to achieve a connected approach to research, learning and teaching, believing that ‘real-world’ research impacts not only the community it operates in, but also a student’s experience across disciplines. This is evident in the way academics draw on their personal research in designing and teaching courses, where their research informs learning activities and academic discussion on contemporary issues. Research tasks are also embedded in many undergraduate coursework programs, providing students with opportunities to grow their understanding through knowledge creation. High achieving undergraduate students also have the opportunity to work closely with discipline research leads through programs such as the Rising Stars program.

RESEARCH CENTRES AND INSTITUTES

CQUniversity has two research institutes – The Appleton Institute and the Institute for Future Farming Systems – and seven research centres including The Centre of Indigenous Health Equity Research, Centre for Intelligent Systems, Centre for Railway Engineering, Centre for Regional Advancement of Learning, Equity, Access and Participation, Centre for Tourism and Regional Opportunities, Queensland Centre for Domestic and Family Violence Research and the Coastal Marine Ecosystems Research Centre.

Located at CQUniversity’s Gladstone Marina Campus, The Coastal Marine Ecosystems Research Centre (CMERC) is the University’s newest centre, having opened in late 2019. The Centre neighbours key multinational industry organisations, a large multicommodity port and the Great Barrier Reef World Heritage Area (GBRWHA). CMERC facilitates collaborative research projects focused on innovative research solutions to develop Australia’s blue economy and enrich its coastal communities, whilst maintaining the health of the environments upon which they are based.

RESEARCH FOCUS AREAS

- Sleep and biological rhythms
- Physical activity
- Human-animal interaction
- Community and disaster resilience
- Gambling and addictive behaviours
- Health promotion
- Human factors and safety science
- Ageing and health
- Agricultural management systems
- Environmental monitoring and management
- Medical and applied physiology
- Advanced clinical practice
- Creative and professional writing
- Digital media
- Education, training and employment pathways
- Performing arts
- Special education
- Scholarship of learning and teaching
- Critical social enquiry
- Health workforce development
- Quality and safety of health and aged care
- Mental health nursing
- Indigenous health equity
- Lived experience led mental health
- Domestic, family and sexual violence
- Simulation and innovative education
- Railway engineering, technology and innovation
- Intelligent systems
- Clean energy
- Building forensics and civil engineering
- Mechatronics, automation and mobile technology
- Engineering and technology education
- Resource economics
- Health economics
- Workforce management
- Regional tourism
- Regional development and opportunity
RESEARCH HIGHER DEGREE TRAINING ACADEMIES

The Research Higher Degree Training Academies aim to attract and train clusters of RHD candidates by specific discipline areas, by cohort profile (e.g. Indigenous) or by geographic cluster (e.g. offshore). Each Academy will be established through demonstrated ability to deliver a culture of research excellence, research impact and research engagement, particularly with respect to timely completions, publications, and partnership opportunities with industry.

CREATIVE ARTS RESEARCH TRAINING ACADEMY (CARTA)

The Creative Arts Research Training Academy (CARTA) supports Masters and PhD students who want to undertake research about, or through, the creative arts. This includes projects founded in both creative practice methodologies and more traditional and applied research methods. Preferred projects may focus on creative writing, including biography, memoir and life writing, and screenwriting, arts and health, or examine arts evaluation, creative arts within the regions, or employment and workforce implications for creatives. Alternatively, projects may intersect with broader areas like literary and cultural studies to investigate such aspects as specific genres, sub-genres, art forms, or the creative arts within the national and/or international landscape. There are also possibilities for these projects to intersect with the Central Queensland Regional Arts Services Network, of which CQU is the service provider. CARTA encompasses a lively and dynamic cohort of creative arts researchers who come together periodically for CARTA events and research intensives. This Academy provides operational funding and scholarship support to encourage growth in research higher degree enrolments and provides development opportunities for existing candidates and their supervisors.

CLEAN ENERGY ACADEMY

The Clean Energy Academy builds on CQU’s research strengths in renewable and eco-friendly sources of energy, power generation, smart grids and distributed intelligent systems, and environmental and applied economics issues. Hosted by the School of Engineering and Technology, the Academy operates across multiple campuses, leveraging and extending the strong connections the University’s clean energy researchers have with the process, energy and resource industries.
The Clean Energy Academy builds on CQUniversity’s research strengths in renewable and eco-friendly sources of energy, power generation, smart grids and distributed intelligent systems, and environmental and applied economics issues.
SCUBA DIVES DOWN

Scuba diving in the Cairns section of the Great Barrier Reef Marine Park is one the most economically significant and largest concentration of dive tourism in the world. However, changing travel patterns of dive tourists, economic factors, governance influences and environmental impacts, especially those generated by climate change, are threatening its long-term sustainability as an iconic scuba dive destination. CQUni PhD researcher Terrence Cummins is in the final stages of data gathering from industry, governance groups and dive tourists. “I hope to be able to generate findings that can be used at multiple levels with the main objective of ‘future-proofing’ dive tourism in the Cairns section of the Great Barrier Reef Marine Park, while maintaining a keen consideration of the Great Barrier Reef as a World Heritage site.”

CREATING ETHICAL FASHION

Australian emerging fashion and textile designers often struggle to build a financially sustainable business that incorporates fair working practices, considerations for the planet and the diverse cultures within. CQUniversity PhD researcher Julie Lantry is aiming to develop a toolkit that could help educate emerging fashion designers on ways to develop a sustainable business model that considers cross-cultural collaborations. Throughout her 30 years of working within the fashion and textile industry, Ms Lantry has seen first-hand the difference ethical collaborative partnerships can have on fashion designers and garment producers, particularly in developing countries. Ms Lantry hopes the developed educational toolkit prototype could be utilised by fashion and textile educators, emerging designers and/or garment producers.

NEW WAYS TO POTTER

The production of ceramics is a field in which many artists work, and sometimes experiment with clay bodies, glazing formulas and firing temperature, but where less formal, university-based research occurs. However, Master of Arts candidate Lisa Brummel has undertaken a practice-led research project investigating alternative ways to adhere glaze to ceramics. Integrating the process of ceramic raku production with methods of metalsmithing and hot glass production, Lisa has been able to achieve a new range of surface effects. The project has provided new opportunities for ceramic practitioners and provided the foundations for further academic research.

ATTITUDES TO SELF-HARM

The attitude a nurse holds towards self-harm patients can impact the behaviour of the patient. Current literature reveals a mix of positive and negative attitudes among Registered Nurses. However, studies have largely taken place in mental health or accident and emergency settings in metropolitan areas. Researcher Carmen Barnard is embarking on a project that will investigate the attitudes of Registered Nurses working in rural and remote Queensland towards self-harm patients. This research will hopefully set the scene for further research exploring whether the attitudes held by nurses affect the behaviour of patients and what further impact this has on patients.

ALTERNATIVE FUEL TESTED

With the world being over dependent on fossil fuels for energy generation, there is a great need for alternative renewable energy sources. The production of biofuel from the seeds of the Beauty Leaf Tree could potentially help to meet this need. As Beauty Leaf Trees thrive in coastal or saline conditions, PhD researcher Rahul Sreekumar is looking at the viability of growing the trees in marginal soils and is currently testing seedlings for stress tolerance and physiological responses. It will also examine the suitability of modern novel technologies like Near Infrared (NIR) and Fourier-transform infrared (FT-IR) spectroscopy in assessing stress tolerance in plants, enabling identification of salt tolerant genotypes in a very efficient, convenient and non-destructive way.

INDIGENOUS LEADERSHIP

Historically, Aboriginal and Torres Strait Islander (Indigenous) peoples have had high rates of unemployment and have been underrepresented in management positions. This research will investigate the drivers and barriers to Indigenous people being employed in leadership positions in the private sector. PhD researcher and recipient of an Advance Queensland Aboriginal and Torres Strait Islander PhD Scholarship Terry Bell says the research looks at how the cultural paradigms between Aboriginal and non-Aboriginal Australians affect employment outcomes in the private sector. The research will be positioned from both employer and employee perspectives to identify the barriers and drivers for Indigenous people to advance into management and will develop an employment strategy that is inclusive, with the aim to improve social and economic outcomes for Indigenous people, and the Australian community.
Dr Melinda Mann’s research into Indigenous students’ experiences of high school and post-school transition to employment and tertiary education has uncovered powerful demonstrations of ongoing Indigenous adolescent development practices and contributed to improved career pathway design for students.
ASTRONAUT FATIGUE ON NASA’S RADAR

Professor Steven Moore

With NASA looking to return to the moon in the next five years, the space agency will need to focus on how it will protect its astronauts from the rigours of space travel.

That’s according to Professor Steven Moore, whose research into astronaut fatigue is one of the key pieces of consideration in NASA’s space program, whether it be a short trip to the International Space Station or one to Mars.

As CQUniversity’s Deputy Dean of Research in the School of Engineering and Technology since 2016, Prof Moore has brought with him a wealth of knowledge and experience in biomedical engineering – including a 20-year stint with the Icahn School of Medicine at Mount Sinai in New York, where he was first approached by NASA to research the health impacts of long duration space travel on its astronauts.

Prof Moore has previously conducted a number of research projects on human vestibular reflexes, before coming to NASA’s attention while undertaking his PhD into 3D eye tracking systems at the University of Sydney. NASA had found that some of its astronaut pilots were experiencing difficulties landing the space shuttle when returning to Earth and invited Professor Moore to delve deeper into the fatigue the astronauts were enduring.

His research, which received $2.7 million in NASA funding over seven years, was conducted at NASA’s Johnson Space Center in Houston and involved two test groups – a group of recently-returned astronauts from six months aboard the International Space Station and a second group of people who were essentially sleep-deprived for 36 hours. The groups were given tasks including operating landing and driving simulators to test their performance.

After returning to Australia and CQUniversity, Prof Moore scrutinised his team’s findings. The research showed that the astronauts had a marked deficit in their hand-eye coordination and their ability to handle multiple mental tasks, compared to the sleep-deprived group. The astronaut group alone also exhibited poor performance on the driving and piloting simulations.

”(The deficit) was very pronounced in the astronauts – the main problem was that they couldn’t handle dual tasks and these were ex-military pilots so the results were quite surprising to us,” Prof Moore explains.

“They not only have microgravity to contend with up there, but also radiation and levels of CO₂ from being in the confined space of the space station for so long.

”However, the astronauts’ coordination deficit was short-lived as they returned to baseline within four days of returning to Earth after six months in space.”

Prof Moore says the findings were of great interest to NASA as it showed that the issue could be managed; and that one solution would be to have astronauts sharing tasks during critical operational tasks such as landing a spacecraft.
With NASA looking to send astronauts to Mars in the near future, and the Trump administration looking to return to the moon by 2024, Prof Moore says his fatigue research was just one of many factors that would contribute to the space agency’s plan.

“They have a group of mission architects who are strategising what a Mars mission would look like. My research has been factored into that mission planning. They’d have to be looking at the design of spacecraft and the affects of zero gravity on the body,” he says.

Prof Moore highlights that some astronauts had suffered and still do suffer the effects of intra-cranial pressure where the lack of gravity forces bodily fluids into the head. He says radiation would also be a major factor with cataracts a common problem for astronauts.

Prof Moore is continuing his research with the Australian Space Agency and NASA. He says the research he conducted had the potential to benefit other CQUinity researchers and students, particularly at the recently opened Cairns Aviation Centre, which has a growing number of aviation research projects. Prof Moore was fortunate enough to acquire a simulator from NASA, and it will soon take pride of place at the Cairns centre.

Ultimately, Prof Moore says the biggest stumbling block for future space exploration would be a political one, but he believes a trip to the moon would make a much-needed practice run for a mission to Mars.
GIVING NEW LIFE TO FOSSILS USING ART AND SCIENCE

Associate Professor Anita Milroy

When it comes to science and art, the two areas don’t often mix – but scanning technology has unlocked a door to the beauty of life from 30 million years ago.

In a world-first trial, CQUndiversity Central Highlands researcher Associate Professor Anita Milroy successfully used Australia’s Nuclear Science and Technology Organisation (ANSTO) Imaging and Medical Beamline (IMBL) at the Australian Synchrotron to reveal the internal anatomy and morphology of rare, three-dimensionally preserved silicified fruits from the Queensland Museum’s type collection.

While the IMBL is traditionally used to reveal minute differences at the interface of air, tissues and bones for biomedical investigations, Assoc Prof Milroy used the football-field-sized synchrotron’s intense beams of light (more than a million times brighter than the sun) to reveal the innermost internal features of these enigmatic fossilised fruits.

“When I first approached physicists about using the synchrotron to ‘look inside’ amber or silicified fossil seeds their response was, ‘We don’t know – let’s try’. We were exploring a completely new concept and were unsure of the outcomes,” explains Assoc Prof Milroy.

“Work in palaeontology requires very sophisticated observational skills and attention to detail – you need to get your eye in to find fossils in the first instance, and then to ‘see’ their characteristics and then utilise these insights to resolve what group of plant they are related to.

“This trial was significant because once we scanned the silicified fossils (originally found in Central Queensland by Lyndal Spackman) using synchrotron radiation, we suddenly ‘saw’ details of their internal structure, ovules and vascular traces, and other features which could assist in classification, narrowing down the field from 10 or more different possible families to one.”

The trial led to a successful application for beam time at the IMBL with Dr Anton Maksimenko (ANSTO) and Dr Andrew Rozefelds (Queensland Museum) forming the research team. The new knowledge was presented in Associate Professor Milroy’s prize-winning doctoral thesis, Epistêmê, technê & poïesis: Visualisations of Extinction and Evolution in Queensland Flora.

The unprecedented detail from the study has allowed us to place these specimens in a phylogenetic sense and assess their affinities to determine their relationships to the modern Australian flora.

“A comprehensive fossil heritage works to tell the story of the past vegetation of the continent and these particular Central Queensland fossils dating back approximately 30 million years tell us what plants were growing in this area at that time,” says Assoc Prof Milroy.

“These fossil seeds and fruits provide connections to the modern flora, advance knowledge of past environments and helps trace the history of rainforest evolution on the continent.”

Creating incredibly high-resolution 3D x-ray imaging might offer much in the understanding of fossil classification, while Assoc Prof Milroy says the impact it has on art is just as substantial.

“It took more than 30 million years to create the works of art (and science), portraits of extinct plants, which otherwise would never have been seen by experts nor...
the general public. We are giving them a new ‘life’ by making art using cutting-edge science and technology.”

Her exhibition Deep Time was hosted in 2017-8 by the Queensland Museum, a popular state venue which attracts over two million visitors per year. “By making the new knowledge available to all in an engaging (and scientifically accurate) format, it effectively democratises the research, and utilises the potential impact that works of art have.”

In addition to 3D models and displays, a seven-minute video of the scans was played on a loop, contextualising the fossils with the respective modern landscapes and flora. This was enhanced by a bespoke piano and synthesised musical accompaniment by Artist Director and Pianist Jenni Flemming.

“Most audiences say, ‘I don’t know what I’m looking at!’ and as researchers, neither do we at first, and that is what makes it exciting, to uncover the connections, share the discoveries, and the new knowledge.

“Art has the ability to democratise research. Most people feel very comfortable interacting and talking about works of art, they are both viewer and critic. Thus, an artistic format can make research more accessible and can facilitate interaction with the public – otherwise it can remain largely unseen in peer-reviewed journals and hidden in official collections.”

Assoc Prof Milroy’s continued collaboration with the Queensland Museum’s Ancient Environments/ Geosciences Program specifically aims to provide a new approach to visualising fossil discoveries and create content not only for scientific publication but for exhibition – engaging an entirely new audience with the research.

Associate Professor Milroy worked on the project with leading expert botanists, the late Professor Trevor Clifford, and QM honorary, Dr Mary Dettmann, and there was mutual inspiration gained from the collaboration. These senior botanists were excited by the new technologies and new information, and Assoc Prof Milroy was, in turn, inspired by their extensive knowledge and research in the field.

“This is work that has legacy. Our small contribution adds to human knowledge and understanding. The more people we can reach the greater the impact.”

Since completing her PhD, Assoc Prof Milroy has continued her search for fossils in partnership with the Queensland Museum, recently discovering a 35-million-year-old ‘horsetail’ (Equisetum) fossil in the Gladstone region.

“Unfortunately, the ‘horsetail’ fossil is an impression and not three-dimensionally preserved so it can’t be studied and used in the synchrotron due to its flattened appearance. Despite its small size (less than one centimetre), it is of great significance to the scientific community, as it is the first time Equisetum has been found in Cenozoic sediments.

“Modern relatives of the fossil plant occur in the northern hemisphere, but not in Australia (in fact modern varieties are considered noxious weeds). The only records are of extinct species — the earliest record of it here was about 95 million years ago, however, this new discovery moves the record to much earlier, at 35 million years.”

DESCRIPTION
By using cutting-edge science and technology, CQUniversity Central Highlands researcher Associate Professor Anita Milroy has created innovative artworks using 30-million-year-old fossils. The project employs synchrotron radiation from the Imaging and Medical Beamline to reveal the internal anatomy and morphology of rare, three-dimensionally preserved silicified fruits.

PARTNERS
Queensland Museum including Dr Andrew Rozefelds, Australia’s Nuclear Science and Technology Organisation (ANSTO) including Dr Anton Maksimenko, Dr Andrew Hammond, Dr Ashley Holmes, Professor Donna Lee Brien, Professor Trevor Clifford, Professor Mary Dettman, Ms Lyndal Spackman and Ms Jenni Flemming.

IMPACT
This project was significant due to the assistance in fossil classification. The study has revealed details that previously were unable to be characterised and provided insights to evolutionary relationships from 30-million-years ago. Additionally, the program has provided a new approach to visualising fossil discoveries and creating content not only for scientific publication but for exhibition – engaging an entirely new audience with the research.
CQUnderstanding York and Planet Ark Power’s micro-grid (solar/battery) project aims at significantly improving accessibility to and affordability of renewable energy for corporate and domestic customers.

Over the past five years, both organisations have made impressive headway towards reaching that goal which, in addition, simultaneously delivers invaluable, environmental benefits.

Micro-grids – small scale power systems that serve local consumers with local generation – are an emerging technology designed to support renewable energy and allow consumers with solar system micro-grids to reduce their dependence on the fossil fuel-powered grid. In the process, greenhouse gas emissions are reduced and costs are cut.

In addition, the means to export excess solar power to the national grid is a major focus of CQUnderstanding York’s and Planet Ark’s combined research.

“Currently, solar energy generated by commercial enterprises which don’t trade on weekends mostly goes unused and generally, such businesses, for technical reasons, aren’t able to export this excess to the grid,” explains Project Chief Investigator Professor Peter Wolfs.

“For example, if a business with a large commercial array was to export a lot of energy, the higher voltages generated could not only be a problem for the business, but also an issue for its neighbours.

“A major focus of our current research is managing exports to safely manage these voltages. Batteries are one technology that can assist.”

Prof Wolfs points out that the goal of the joint research wasn’t to reinvent batteries and solar cells, both of which have been around for a long time, but to derive the maximum value and efficiency from existing systems.

“In recent years, solar has become extremely affordable. Battery prices are coming down, but they still remain expensive and their lifetimes are limited.”

Prof Wolfs explains that battery optimisation relies largely on accurate energy forecasting. “Our work focuses on forecasting daily loads and solar generation and then carefully optimising both the size and the use of batteries to get the best economic benefit.

“Impressive results include the development of some very good power electronic equipment for matching batteries to the grid and to solar cells. That really has been an important product for Planet Ark Power, as is our battery forecasting and management system which we’ve just finalised.

“What we’ve achieved to date is already having a significant impact on the quality of the energy solution Planet Ark Power produces.”

Planet Ark Power Chief Technology Officer Dr Bevan Holcombe identifies community scale generation as one of renewable energy’s more important expanding markets.

“Small communities might include a remote township or an urban collective of home owners who want to collaborate in securing a better energy future,” he says.

“So in order to control and manage their resources for the best price and environmental outcomes, these micro-grids need well designed controls.

“And while the economic and environmental benefits of renewable energy aren’t disputed, considerably improved technology is needed to make it widely available and more affordable.

“To this end, CQUnderstanding York helps us with software development and also some of the hardware for this micro-grid project.”
Dr Holcombe points out that it would take several years to develop both software and hardware to the extent where a community could run completely off renewable energy, without connection to the grid or any other fossil fuel generating source.

“So, Planet Ark Power is always looking to improve battery control and management, and as prices come down, the scope of this increases as more and more clients became involved.

“Work is also continuing on improving battery management for solar powered houses, in addition to another research project on remote power supplies for individuals and local communities.

“Yes, we have lots of solar panels and batteries are coming along nicely, but we don’t yet have the management software and technology for the most efficient, future renewable energy source.

“The current Australian grid took over 100 years to develop and we’ve probably been working on the renewable grid for only 10 to 15 years, so we’ve still got a long way to go.”

Prof Wolfs describes renewable energy’s future as exciting and unstoppable. “Planet Ark Power anticipates moving from 20 per cent solar energy storage to beyond 50 per cent within the next few years and it further anticipates the next big market, that of companies currently running a 500 kW system, for example, progressing to systems 10 to 100 times more powerful,” he says.

“They’ve already carried out export trials along such lines and they’re most heartened by the corporate and scientific support they’ve received.”

**DESCRIPTION**

The joint micro-grid (solar/battery) project undertaken by CQUniversity and Planet Ark Power aims to reduce demand on the public power system through renewable energy use, enabling Planet Ark Power to provide lower costs and services to customers. Major research into improving battery storage and life, and making batteries more affordable, also constitutes an important part of the project, as does improving export options, particularly in the case of large business enterprises.

**PARTNERS**

Planet Ark Power

**IMPACT**

CQUniversity and Planet Ark’s research into micro-grids will allow future consumers to reduce their dependence on the fossil fuel-powered grid and in the process reduce greenhouse gas emissions and cut their energy costs.
EXERCISE TO HELP ON-CALL WORKERS FIRE UP

Dr Grace Vincent

In the moments immediately after waking, when Australia’s on-call workers may need to make life or death decisions or drive themselves towards danger, their performance is not at its peak.

That’s why CQUniversity’s Senior Postdoctral Research Fellow, Dr Grace Vincent, and her research team, are helping experts ‘wake up’ to the countermeasures of impaired performance, during times of sleep inertia (grogginess upon waking).

The CQUniversity Appleton Institute research project suggests that countermeasures, such as introducing 30 seconds of intense exercise upon waking, will go some way towards helping improve on-call workers’ alertness.

Australia’s on-call workforce is a critical component of the systems that protect the nation’s economic, commercial, environmental, social and cultural interests and assets.

Hundreds of thousands of Australian workers and volunteers are regularly on stand-by, to be called to respond to natural disasters, domestic threats, medical emergencies, infrastructure failures, and transport accidents.

According to Dr Vincent, sleep deprivation is costing the Australian economy $66 billion dollars and kills about 3000 people per year, due to associated physical and mental health issues and accidents.

“Some of the most sleep deprived people in our communities are our on-call workers – our paramedics, doctors, nurses, and, of course, our firefighters,” she explains.

“One of the major risks associated with sleep deprivation is the impact it has on performance, particularly upon waking, when an individual is likely to experience sleep inertia.

“For most people, this impact is inconsequential, easing their way into full waking function before taking on daily activities. Others don’t have this luxury.”

For years, Dr Vincent and her research team, and other experts, investigated strategies for accelerating the transition from sleep to optimal waking function – light, loud alarms, caffeine and cold showers. However, these were either impractical in an emergency scenario or didn’t reduce sleep inertia fast enough.
In 2018, after speaking with firefighters about effective strategies, the idea of completing five star jumps before commencing work was put forward. We already knew that exercise can increase adrenaline by up to 10 times, and this can increase alertness,” says Dr Vincent.

“Obviously we couldn’t expect firefighters to complete half an hour of exercise before an emergency. Therefore, we decided to test whether firefighters experienced an increase in adrenaline after 30 seconds of exercise upon waking.”

Dr Vincent sought participants and ran several experiments in the sleep laboratory where volunteers were woken at 2 am, before having to sprint as hard as they could for 30 seconds on an exercise bike.

“The research team took blood samples to measure adrenaline and checked how participants were feeling, by assessing how alert they were and how well they performed certain tasks over a one-hour period.

“The most important finding was that 30 seconds of exercise increased participants’ adrenaline by five and half times within the first five minutes. Thus, when participants exercised, they were significantly more alert than when they didn’t exercise.”

CQU’s sleep inertia research project team continues to test the theory that a short burst of energy, in combination with caffeine, is a practical countermeasure to sleep inertia.

“Typically, we don’t actually manage the sleep inertia effect, so anything that has scientific basis to help firefighters do their job has got to be a good thing. It’s quite simple and easy to do so I definitely feel this is something we need to continue investigating,” explains Dr Vincent.

“Currently we are applying for funding to extend the research. To assess actual performance, we will test participants on a range of physical and cognitive tasks following 30 seconds of exercise, to see whether this reduces sleep inertia.”
COMMERCIALISING CARBS HAS SWEET BENEFITS FOR ALL

Professor Philip Brown

Sweet potato is the most important vegetable crop in Papua New Guinea (PNG), however, over time it has become heavily infected with viral diseases, leaving many locals with low yields.

Thanks to a landmark research project, led by CQUniversity, technologies are currently being trialled to help improve crop yields and quality, and examine value chains to connect growers to markets and provide rural communities with a new source of income.

At the same time, the Australian sweet potato industry is benefitting from the development of new virus detection methodology and knowledge of the viruses prevalent in PNG that may be a biosecurity threat to Australian growers.

Project work commenced in 2017, when CQUniversity’s Institute for Future Farming Systems commenced research into the commercialisation of PNG’s sweet potato crop, thanks to a $5 million Australian Centre for International Agricultural Research (ACIAR) grant.

The five-year project involves international collaboration with the PNG National Agricultural Research Institute and Fresh Produce Development Authority, as well as the Queensland Government’s Department of Agriculture and Fisheries and the Australian National University Enterprises.

CQUniversity Professor Philip Brown said PNG farmers had historically grown sweet potato, also known locally as kaukau, by planting cuttings taken from old crop, which meant if the original crop was infected with a virus, the new crop would be too.

“Crops grown from clean kaukau have up to 50 per cent higher yields than the same variety before virus removal. The kaukau roots are also smoother and a more even shape, making them more attractive to buyers. Farmers have also reported that they taste much better.

“To generate a large volume of clean kaukau vines for distribution to farmers, the project has established 14 commercial scale insect proof screenhouses. Clean planting material can be produced in these structures as the aphids (small sap-sucking insects) and white fly, that transmit the viruses from infected to non-infected plants, cannot enter.”

Prof Brown says PNG farmers who grow kaukau as a commercial crop were required to find markets that would provide them with a reliable source of income. “Most produce in PNG is sold through open marketplaces in towns and cities, but supermarkets are emerging as a new market for fresh produce.

“More affluent consumers in the cities are prepared to pay more for produce in supermarkets as the shopping experience is safer than the open markets. Therefore, the project team, led by the Fresh Produce Development Agency (FPDA), have assisted farmers to gain access to these supermarkets.

“The volume of kaukau being transported from the PNG highlands to the coastal cities of Lae and Port Moresby is growing, as farmers build more robust value chains to these cities. The project team will continue to support the development of value chains for kaukau to this higher value market.”

The success of the project, thus far, has been a direct result of a comprehensive training and capacity building program. By working with local communities in order to align the training program to their wants and needs, project partners have improved farmers’ skills and knowledge to allow them to better produce and market kaukau.

Prof Brown says the project hadn’t been without its challenges. “There are many logistical challenges and cultural issues that need to be addressed when implementing the clean kaukau production and distribution scheme. The CQUniversity research team is, however, committed to investigating these issues in order to implement evidence-based solutions.”
DESCRIPTION
Working in partnership with Australian and PNG organisations, CQUiversity is leading a research project that delivers new income generating opportunities and improved livelihoods for PNG farming communities. The project team is making pathogen-free sweet potato planting material available to local farmers, in order to increase crop yield and quality, and helping farmers access markets for their produce.

PARTNERS
Australian Centre for International Agricultural Research, Fresh Produce Development Agency (PNG), National Agriculture Research Institute (PNG), Queensland Government’s Department of Agriculture and Fisheries and Australian National University Enterprises

IMPACT
Rural communities in the PNG highlands are earning an income from growing and selling sweet potato, traditionally just a subsistence crop in PNG, and are benefitting from resulting improvements in their livelihoods. The Australian sweet potato industry is benefitting from the development of new virus detection methodology and knowledge of the viruses prevalent in PNG that may be a biosecurity threat to Australian growers.
NEW TREATMENT COULD HELP VICTIMS OF SPINAL CORD INJURIES

Dr Vanesa Bochkezanian, Dr Luke Heales, Dr Steven Obst, Sasha Job, Dr Lee Barber (The University of Queensland) and Dr Gabriel Trajano (Queensland University of Technology)

A car crash can happen in a split second, but the aftermath can seem an eternity for victims who suffer injury to their spinal cord and are confined to a wheelchair.

Spinal cord injury often interrupts connections between the brain and nerves in the legs, while injuries that are higher up the spine can also affect the arms. People who lose voluntary control of movement can develop problems with spasticity – a continual involuntary contraction of their muscles which can cause stiffness or tightness.

Medical research and new technologies are progressing, and everyone is hoping that effective treatments for spinal cord injuries will soon be a reality.

CQUniversity Neurological Physiotherapy researcher Dr Vanesa Bochkezanian says it’s vital that people with spinal cord injuries maintain their muscle strength and mass while waiting for effective solutions.

“Without movement in their limbs, people who are sedentary may be at increased risk of cardiovascular disease, deep-vein thrombosis, pressure sores and interrupted sleep,” she says.

“Meanwhile, there’s a lot of research going on into treatments involving stem cells and even epidural stimulation … electrodes applied directly to the spinal cord are able to activate damaged nerves.”

A few years ago, before arriving at CQUniversity, Dr Bochkezanian conducted a study into a form of strength training rarely used on patients with spinal cord injury. As part of her PhD degree at Edith Cowan University, she found that high-intensity neuromuscular electrical stimulation (NMES) showed benefits for five patients with chronic spinal cord injury.

NMES strength training – the use of electrical impulses to contract muscles – is usually performed at low intensities for spinal cord patients, due to assumed tolerance levels.
It’s vital that people with spinal cord injuries maintain their muscle strength and mass while waiting for effective solutions. This project aims to assess the benefits of high-intensity neuromuscular electrical stimulation for people with a spinal cord injury.

**PARTNERS**  
SpinalCure Australia

**IMPACT**  
People with a spinal cord injury can have a better-quality life and better long-term prospects as they await a cure for their condition.

“Our patients using the high-intensity stimulation not only tolerated the intervention but also demonstrated reduced spasticity, improved thigh muscle strength, improved cholesterol levels and trends towards a better quality of life,” Dr Bochkezanian explains.

“During the study, we were able to objectively measure muscle size, and blood tests indicated changes in anti-inflammatory measures, but for one of our measures we relied on subjective reports on levels of spasticity.”

CQUniversity has matched a grant from SpinalCure Australia to purchase the latest NMES equipment for the project.

However, before embarking on a larger study of the benefits of NMES, Dr Bochkezanian plans a complementary study to assess whether the latest spasticity monitoring gear housed at CQUniversity Bundaberg can be considered an objective and reliable measure of muscle spasticity.

“Our initial study was a clear example of how the use of high-intensity muscle strength training electrical stimulation in the legs of patients with spinal cord injury can help them become stronger, healthier and happier.

“We want to ensure we have more objective measures of success when we do our expanded study.”

According to the Spinal Cord Injury Network, more than 10 000 people in Australia are living with a spinal cord injury – 80 per cent of them are male.

Dr Bochkezanian has come a long way from Argentina to live and research in Australia and now her future study may also have potential application for people with brain injuries, multiple sclerosis and stroke, or anyone who might not be able to fully activate their muscles.

In that sense, her journey half-way around the globe may open up a world of potential to improve people’s lives for the better.
One day in the not-too-distant future, a diner in Singapore or Jakarta could be enjoying a steak sourced near the beef capital of Australia, Rockhampton, with a gravy prepared from spices and condiments which were also grown in tropical Australia.

That’s the end game of a research project involving CQUniversity, AgriVentis Technologies, a range of other stakeholders, and farmers throughout central and northern parts of Queensland and the Darwin and Katherine areas of the Northern Territory.

CQUniversity and AgriVentis have conducted glasshouse trials of cumin, fennel, kalonji, caraway and black sesame, with results showing they have strong potential for inclusion in broadacre crop rotations.

The project has gained funding from the CRC for Developing Northern Australia (CRCNA). Rockhampton Regional Council has also been involved in helping to create links with food companies in Asia.

CQUniversity researcher Dr Surya Bhattarai says that some initial trials of black sesame and fennel crops had started, while the other crops would be planted in the winter of 2020.

“We have a number of varieties of these crops with different genetics and we are looking at different growing conditions at six different growing locations,” he says.

“The project is based on our previous glasshouse trials, and now we’re starting the journey to find the best ways to incorporate these crops into broadacre farming rotations; not to replace existing crops, but to work out how spices can complement current practices.

“The spices market is growing rapidly. At the moment, the global trade is about $12 billion in US dollars, but it has had a sustained growth of over five per cent a year over a long period of time and is expected to continue to grow.

“The internal demand for spices in Australia is also increasing gradually. We are not yet a big spice consumer, but our industry partner, AgriVentis, is looking at exporting these crops to the high-value markets overseas.
CQUniversity researchers are seeking the best ways to incorporate key spices and condiments into broadacre farming rotations.

**PARTNERS**
CRC for Developing Northern Australia, AgriVentis Technologies, NT Department of Primary Industries, WA Department of Primary Industries, Burdekin Bowen Integrated Floodplain Management Advisory Committee Inc (BBIFMAC), TRAP Services, Rockhampton Regional Council and farmers in Rockhampton, Biloela, Bowen and Tully

**IMPACT**
Spices and condiments from Northern Australia could forge new markets in Asia.

“For example, they are looking at exporting the black sesame to Japan, Korea, Singapore and China.

“We are also looking at the potential for value-adding in the value chain in terms of the processing and packaging and diversifying of export markets.”

Dr Bhattarai says the current consumer movement embracing health foods could also help build additional potential for the spice and condiments markets in Australia and across the globe.

The project will be rolled out across three stages, starting with small-plot scoping of the success rates of various crops in different environments, administered by researchers with the participation of farmers.

The next stage will involve larger-plot verification studies of multiple varieties, administered by farmers and with the participation of researchers. The final stage will involve innovation and commercialisation.

“We will see in the first year what grows, in the second year the farmers will try on their own and in the third year, if they see opportunities to scale-up production, they will be able to negotiate with AgriVentis and there will be a transition to commercialisation.”

Australia currently imports 94 per cent of spices and condiments for the domestic market, including 100 per cent of black sesame, which is recognised as the oldest oilseed crop on the planet.

Mainly used as oil for its rich source of nutrients and nutty flavour, demand for black sesame is said to be increasing globally.

Co-researcher Professor Kerry Walsh says the yield of black sesame trials at Alton Downs had exceeded expectations, despite the long period of drought conditions.

Prof Walsh says Rockhampton Regional Council had helped create possible trade and investment opportunities for Aussie spice crops with one of South Korea’s largest food and manufacturing companies.

The Spicing Up the North project is funded by the CRC for Developing Northern Australia, with research led by CQUniversity in partnership with AgriVentis Technologies, NT Department of Primary Industries and Resources, WA Department of Primary Industry and Regional Development, BBIFMAC, TRAP Services, Rockhampton Regional Council, and farmers in Rockhampton, Biloela, Bowen and Tully.
CAPILONG OIL BECOMES A PRODUCT OF BEAUTY FOR INDONESIA

Associate Professor Nanjappa Ashwath and Dr Lily Ishak

A CQUiversity-led research project into the environmental and medicinal benefits of capilong oil (or beauty leaf tree oil) is reaping rewards for Indonesia’s rural industry.

Conducted by CQU alumnus Dr Lily Ishak and overseen by Associate Professor Nanjappa Ashwath, the project also has the potential to provide a new source of biofuel production.

Since 2018 Dr Ishak has been working closely with the villagers and farmers on Ternate Island to harvest dried kernels from the capilong tree and extract the oil using a manual oil press.

The project encourages uses of the beauty leaf tree as a source of biokerosene and biofuel to reduce dependency on fossil fuel energy while retaining plantings to minimise soil erosion from windstorms, improve degraded mined land, and address the threat of the tree’s extinction through land clearing.

Her work was recognised by CQU this year when she was named the 2019 Alumnus of the Year – Early Career Achievement for her contribution to research, education and innovative practical applications of environmental sustainability.

“My team and I have been engaging villagers to develop a small-medium enterprise to produce the oil,” explains Dr Ishak.

“There are two different groups of women involved – one that collects the fresh fruits from the capilong trees and processing them to provide the dried seeds and the other which works on processing the kernels to produce the oil.”

While the process has not yet produced a perfect biokerosene product, the oil has been supplied to a local cosmetics company that has used it as a raw material to make soaps, shampoo, moisturiser and body lotions. In turn, the villagers can earn money from this additional work.

“Unfortunately, because the press is used manually, it’s unable to extract 100 per cent of the oil contained in the seeds – the process only collects about 50 to 60 per cent of the oil.

“The villagers don’t have enough financial capital to buy a screw hydraulic press that would work better than the manual press and extract about 80 per cent of the oil from the seed.”

Dr Ishak says another challenge was acquiring the chemicals – phosphoric acid (H₃PO₄) to help separate the gum from the oil, but the villagers were adept at making good use of the attainable product.

“Once the villagers learned the multiple uses of the oil, they were able to extend the use of the crude product for skin care, and to treat burns, boils and other skin irritations.”

She says the biofuel applications of capilong oil had many benefits for the villagers and the greater population. “The by-products of oil extraction and biodiesel conversion process can be converted to syngas from which electricity can be generated.

“The environmental flow-ons from the use of the product include reduction of greenhouse gasses and improvement of soil health via the use of biochar and bioliquor. The community benefits include alternate income for villagers via the sale of capilong seed or oil.

“The oil could also have positive social effects, by bringing the community together to create alternative income and improving the standard of living for rural people. It can reduce the migration of people into larger cities and create long-term sustainability of the intensive lifestyle.”

The project has thrived on funding provided by the Australian Government through the Australian Alumni Grant Scheme and the associated research findings are being collated into research paper. Further research will examine the economic values of diversifying the use of the oil either as a biofuel, or in cosmetic or pharmaceutical products.

Dr Ishak and her team are also awaiting the outcome of another funding application to the Australian Aid: Friendship Grants Program.
DESCRIPTION
CQUniversity’s beauty leaf tree project continues to reap rewards for people in rural Indonesia and has potential medicinal, cosmetic and energy benefits for the rest of the world. Working side-by-side with local villagers, CQUniversity has developed a process to extract capilong oil from the dried seeds which is currently being used to make soaps and other cosmetic items, but also can produce biofuel.

PARTNERS
Villagers on Ternate Island, Indonesia, and the Australian Government through the Australian Alumni Grant Scheme

IMPACT
The project has helped villagers generate additional income, forge closer relationships with themselves and Australia and opened up numerous opportunities for future development. The findings will be collected in a yet-to-be-published research paper and more work will be conducted to examine the economic values of diversifying the use of the oil either as a biofuel, or in cosmetic or pharmaceutical products.

“"The environmental flow-ons from the use of the product include reduction of greenhouse gasses and improvement of soil health via the use of biochar and bioliquor. The community benefits include alternate income for villagers via the sale of capilong seed or oil.""

“This collaboration between Indonesia and Australia has been very effective in transferring the technology from the laboratory to the villagers in Indonesia,” she says.

“This effort has created a positive environment of harmony amongst the Indonesian people in regard to Australia.”
Imagine waiting at the bus stop, not knowing if you can board the next bus – or even the one after that. Mobility aids should allow greater freedom for a growing sector of the Australian community, but public transport access is still a gamble for thousands of users with restricted mobility.

Public transport should be for all Australians, and national standards for design of both mobility aids and transport vehicles are meant to ensure easy access.

So, when CQUniversity researcher and occupational therapist Professor Carolyn Unsworth found that most people still have difficulty getting their powered mobility aids on and off public transport, she was determined to make getting around easier for nearly a quarter of a million Australian users.

“There are hundreds of different models of powered mobility aids currently used in Australia, and similarly there are hundreds of different bus layouts that they have to navigate,” Prof Unsworth explains.

“It seemed incredible to me that consumers, vendors and the health care professionals involved in recommending mobility aids had no way of knowing which powered mobility aids are compatible with which public transport configurations.”

In 2017, Prof Unsworth’s pilot research project with 67 mobility aid users across Victoria and Queensland, asked participants to outline their public transport experience, and obstacles and barriers within vehicle layout.

“That project showed we needed more data across the range of models, but we needed a more efficient way to gather it, than just riding buses all day!” she says.

The solution: Prof Unsworth’s multi-disciplinary team of engineers, psychologists, and educators developed world-first 3D scanning technology to model mobility scooter movement through bus passageways.

The innovative approach saw 3D scanning, and the use of open sourced graphics software, model 35 different mobility scooters exactly to specifications, then run them against a custom collision-detection algorithm using 21 bus scans.

Funded by Public Transport Victoria (now the Department of Transport), and with the support of Scooters Australia, CDC Bus, and Monash University’s Immersive Visualisation Platform, the research method paves the way to better shape design, regulation and government policy in transport and health.

“This approach provides highly accurate yet custom information to people who want to access buses in their mobility aids, and it addresses a huge gap in knowledge for this growing sector of the community,” says Prof Unsworth.

“It’s also highlighted that existing standards for accessibility design are based on 2D floor areas and don’t take into account the impact of raised impediments like electronic ticket scanners or rails, and of the skill, weight and experience of the users.”

As well as providing the findings to participants, Prof Unsworth then worked with a CQUni Master of Information Technology student, to develop a customer-facing mobile phone app using the results from the research.

“The app shows how easily consumers could choose a mobility aid that will fit most buses and get real-time updates on whether the approaching buses will accommodate them,” she explains.

Since finalising the research, Prof Unsworth and her team made a submission to the 2018 inquiry: “Senate Standing Committees on Rural and Regional Affairs and Transport, Inquiry into the need for regulation of mobility scooters, also known as motorised wheelchairs”
She also presented in person, highlighting the need for systemic change to make community infrastructure more accessible for all Australia.

“The issue of community transport mobility is still affecting people across all age groups, and all people with a variety of disabilities need to access the community, but they aren’t getting the right assessments or support to remain mobile,” she says.

“Understanding the barriers – and that includes physical barriers – is a vital step to improving their access and experience across the board.”

Prof Unsworth’s research was published in the international Journal of Transport & Health and Disability and Rehabilitation: Assistive Technology, and has been presented at a range of conferences and community events.

Prof Unsworth’s team developed world-first 3D scanning technology to model mobility scooter movement through bus passageways.

DESCRIPTION
People with disabilities rely on public transport, but those using powered mobility aids are often unable to access difficult vehicle layouts. This world-first research, sponsored by the Victorian Department of Transport and working with a range of transport and assistance organisations, used 3D scanning technology to model a range of mobility aids against a bus collision-detection algorithm, and identified barriers for users.

PARTNERS
Victorian Department of Transport (formerly Public Transport Victoria)

IMPACT
People using powered mobility aids, disability sector workers, and public transport planners, now have a better understanding of best models for public transport access, and what design considerations should inform policy for future access. This information has been disseminated to a wide audience through Prof Unsworth’s community engagement, and the world-first approach will enable further custom research, and user-facing solutions, in Australia and internationally.
A HEALTH CARE EARLY WARNING SYSTEM GIVEN THE GREEN LIGHT

Professor Trudy Dwyer, Dr Tracy Flanady, Professor Tania Signal, Professor Matthew Browne, Dr Danielle le Lagadec and Central Queensland Hospital and Health Service industry partner Ms Julie Kahl

A CQU research team has established that an early warning system (EWS), designed to support nurses and doctors to quickly identify when a patient’s condition is worsening and when to escalate care, does work when used correctly.

In setting out to validate the extent EWS can predict patient clinical deterioration, researchers focused on how the most prevalent EWS were currently used in public hospitals across Queensland.

In total, 2474 patient charts and 12 399 sets of patient vital sign measurements from 13 different hospitals, found that abnormal respiratory or cardiac changes commonly preceded unexpected clinical deterioration.

Better still, when these individual abnormal vital signs were considered collectively as one total score, the early warning system had a better than average chance of predicting clinical deterioration 24 hours preceding serious clinical deterioration.

Significantly, if early detection is acted upon, patient mortality rates and unplanned intensive care unit admissions can be reduced, and patients’ length of hospital stays are shorter.

The study was lead by Chief Investigators Professor Trudy Dwyer and Dr Tracy Flanady, both from CQU Rockhampton; CQU team members Professor Tania Signal, Professor Matthew Browne, Dr Danielle le Lagadec; and Central Queensland Hospital and Health Service industry partner Ms Julie Kahl.

Prof Dwyer explains that the study arose in response to the findings of coronial inquiries into hospital deaths because staff had not complied with the early warning system protocols.

"When exploring why staff don’t comply, the research team found that staff don’t have confidence that the early warning system charts are relevant to all patients on all occasions. As a result, they aren’t used as intended."

The early warning system examined comprises a single and multi-trigger tracking system that requires clinicians to collect and record patients’ vital signs. The EWS allocates scores for each vital sign outside a healthy range, then the aggregate score determines escalation protocols for clinicians to enact once certain predetermined thresholds are met.

However, for the system to work at optimum level, it’s essential that the EWS accurately detects deterioration and that staff comply with escalation protocols.

Prof Dwyer stresses that given the validation of this early warning system, improving the confidence of those who used them was critically important in avoiding future patient deaths.

She says it was found that staff’s negative perceptions of EWS benefits related to the undermining of clinical experience, inhibited clinical skills development and the fact there was no consequence for non-compliance.

Professional hierarchy, dissatisfaction with management, plus insufficient and diverse training were all identified as factors that negatively impacted compliance. Casualisation of the workforce contributes to non-compliance.

The perception of the current training for EWS indicated a diverse workforce required more diverse training that targets specific chart nuances such as blood pressure, modifications, pain and sedation and chart modifications.

Regarding education and training, an urgent focus on completing patients’ usual/default blood pressure and the correct use/fulfilment of the temporary and permanent modifications section, modification is required when symptoms related to a patient’s chronic medical condition. For example, a person with known Chronic Obstructive Pulmonary Disease (COPD) has the potential to repeatedly trigger unnecessary clinical interventions.
The aim of the study was to examine the effectiveness of an early warning system to detect adult clinical deterioration within Queensland hospitals and to identify the socio-cultural factors influencing health professional compliance in using the EWS.

Impact
The study confirmed that the total early warning score does predict early deterioration. Addressing socio-cultural factors such as individual confidence in the EWS, patient safety values and organisational culture have the potential to influence staff compliance.

While staff are receiving training, this training is not meeting their needs. With consumers expecting the best possible health care, the EWS study provides the potential to improve delivery of this expectation, resulting in substantial social impact, shorter hospital stays and better quality of life.

In relation to practice changes, it was noted that while the modification section allowed for medical officers’ clinical judgement/reason, the charts provided limited scope for registered nurses to use their clinical judgement.

Research recommendations further included that of a different sampling method (that of random sampling of patients as opposed to medical emergency team review (MET) and matching), a method which would potentially provide improved predictions for clinical deterioration. Professional tensions between the home team and the MET were also identified as an issue requiring attention and further research to improve partnerships between the teams to optimise patient outcomes was recommended.

“We have confirmed that EWS charts do predict deterioration, so knowledge and awareness are vital in improving the confidence of those who use the charts,” says Prof Dwyer.

“In conclusion, complete compliance to these recommendations would no doubt significantly improve clinicians behaviour in EWS monitoring and escalation protocols compliance to the extent that unnecessary patient deaths due to cardiac or respiratory arrest are things of the past.”

Description
The aim of the study was to examine the effectiveness of an early warning system to detect adult clinical deterioration within Queensland hospitals and to identify the socio-cultural factors influencing health professional compliance in using the EWS.
BUSH PUSH REQUIRED TO MAKE MIGRANTS AT HOME IN THE REGIONS

Professor Julian Teicher, Dr Ataus Samad, Associate Professor Delwar Akbar and Professor Susan Kinnear

Without Australia’s growing stream of migrants, the nation’s population would soon be going backwards. However, outside of capital cities, communities aren’t getting the benefit of the growth.

According to the Department of Home Affairs, 101,255 migrants arrived in Australia in 2017/18. Of these, only 6,637 settled in regional Australia.

Now, CQUniversity researchers are trying to understand ways to reverse the trend and attract more new arrivals to the regions.

In 2018, Professor Julian Teicher led a pilot research project into migration and settlement drivers, and what government, employers and communities can do to entice more migrants to work and live in the regions.

The resulting report, Achieving secure and stable migrant employment: A study of agriculture, manufacturing and food processing in regional Queensland, was supported by CQUniversity’s Centre for Tourism and Regional Opportunity, and was launched by Queensland Minister for Multicultural Affairs Stirling Hinchliffe.

Prof Teicher says findings highlighted regional industries’ existing reliance on temporary migrants, such as backpackers, working holidaymakers and seasonal Pacific Islander workers.

However, he says both communities and industry would benefit if these workers could make the move permanently, and that employers are looking for solutions to create ongoing roles.

“If obstacles can be overcome, including the seasonality of work, there are significant social and economic benefits in attracting permanent migrants to regional industries,” says Prof Teicher.

“Many respondents indicated a crucial need for both unskilled and skilled employees, especially as regional Australian agribusiness embraces ‘agri-tech’.”

In interviews held across Central Queensland, CQUni researchers spoke to 25 employers and agricultural industry leaders, from organisations including Tey’s Australia, Bundaberg Fruit and Vegetable Growers, Office of Northern Australia, AusIndustries, AgForce, Queensland Agricultural Workforce Network, Queensland Farmers’ Federation, Rural Jobs and Skills Alliance (RJSA), Australian Meat Industry Council, Regional Development Australia and Multicultural Development Australia.

Social barriers, including language proficiency, skills recognition, concerns about work availability, and lack of existing cultural community, were all perceived as prohibitive to migrants settling in regional areas.

“Future research should address the role that leadership plays in close-knit migrant communities in terms of building bridges with employers in regional Australia and facilitating integration within regional communities,” says Prof Teicher.

The report highlights a failure in attempts to “re-settle” migrants, placing them first in capital cities, then trying to encourage them to relocate to regional areas.

“We found that the current process of resettling people from metropolitan cities to regional areas is difficult because once people settle in big cities, they are reluctant to move.

“To achieve direct migration to the regions, it will require a rethink of government policy settings, pre-matching of migrant skills with job opportunities, building of infrastructure, support networks and community capacity, and promotion of regional communities.”
“If obstacles can be overcome, including the seasonality of work, there are significant social and economic benefits in attracting permanent migrants to regional industries.”

While the size of this project meant researchers were limited to interviewing employers and industry peak bodies, Prof Teicher says the next step had to include migrant voices and their experiences.

“Again and again, our research found over-reliance on temporary migrants comes with a whole series of costs due to high labour turnover, strict visa conditions, higher wages and other procedural aspects.

“So there is a real incentive for better understanding what would more effectively attract permanent migrants, and a whole-of-community approach to making that happen.”

**DESCRIPTION**

This 2018 research project analysed existing data on migration to regional Australia, and gathered input from employers, peak bodies and government, to better understand current barriers to permanent migration, and how more new arrivals could be attracted to regional jobs and communities.

**PARTNERS**

CQUniversity Centre for Tourism and Regional Opportunities (CTRO)

**IMPACT**

The project identified a range of barriers currently contributing to low regional migration rates, engaged and challenged leaders across the agricultural industry and government to consider what initiatives could increase migrant participation in the agricultural sector, and identified opportunities for further analysis of migrant attitudes to regional work and living.
The CQU University Awards for Outstanding Researchers recognise outstanding researchers who have made a significant contribution to enhancing and supporting research activities at CQU University. The awards are intended to acknowledge the achievement of research outcomes by researchers and to recognise the important role research leadership plays in the research culture at the University.
VICE-CHANCELLOR’S AWARDS FOR OUTSTANDING RESEARCHERS

ASSOCIATE PROFESSOR JANYA MCCALMAN

Vice-Chancellor’s Award for Outstanding Researchers – Early Career Research

Associate Janya McCalman is a NHMRC early career research fellow in public health and the Deputy Director of the Centre for Indigenous Health Equity Research at CQUniversity. Janya completed her PhD in 2013 and has worked as a researcher in Indigenous health for over 10 years. She has been instrumental in securing over $6 million in competitive grants since 2013. Janya has published over 40 articles in national and international peer-reviewed journals and produced four books or book chapters and numerous reports for government and community-controlled organisations. She has also contributed to policy directions and developed community health and educational resources. Janya’s research with Aboriginal and Torres Strait Islander people has a focus on supporting Indigenous people to take control of their own research and development agenda to improve the determinants of their own health.

ASSOCIATE PROFESSOR ANJUM NAWEED

Vice-Chancellor’s Award for Outstanding Researchers – Mid-Career Research

Associate Professor Anjum Naweed has over 10 years of experience across a range of industry sectors, complex domains, and occupational settings and was awarded a prestigious ARC Discovery Early Career Researcher Award Fellowship. Anjum’s simulation-based research has focused on trying to understand and enhance the way that people perform in complex, and often, highly safety-critical environments. In particular, Anjum has built an outstanding international reputation for exciting and novel research in Rail Human Factors and is passionate about improving rail safety. Anjum has co-edited books, written over 60 peer reviewed articles and secured over $2 million in research funding in human factors and safety work. His research has also received numerous awards and accolades. Through his research Anjum seeks to understand and pursue practical advances that improve how people function and interact with their environment in the real world.
RESEARCH HIGHER DEGREE (RHD) AWARDS

ASSOCIATE PROFESSOR ANTHONY WELCH
Award for Excellence in RHD Supervision for 2018

DR JOSHUA TRIGG – DOCTOR OF PHILOSOPHY
Outstanding Research Higher Degree Thesis Award for 2018

DR LORETTO QUINNEY – DOCTOR OF PHILOSOPHY
Thesis Excellence Award for 2018

DEREK MITCHELL – MASTER OF EDUCATION
Thesis Excellence Award for 2018

DR HANAN AL-SHAMALY – DOCTOR OF PHILOSOPHY
Thesis Excellence Award for 2018

GAIL FORRER – MASTER OF ARTS
Thesis Excellence Award for 2018
ENGAGE WITH US

CONSULTANCY
Industry organisations can engage with CQUniversity Australia researchers and/or facilities to provide expertise and a range of testing services on a fee-for-service basis. CQUniversity consultants can also be engaged to undertake confidential research activities where the data and results are owned wholly by the commissioning industry party.

CONTRACT OR COLLABORATIVE RESEARCH PROJECTS
Contract or collaborative research projects range from small-scale, short-term projects to major multi-year collaborative projects. Industry partners may fully fund the direct research costs of the projects or partner with CQUniversity to leverage funding from agencies such as the Australian Research Council or state government programs such as Advance Queensland. Ownership of intellectual property arising from the research activities are negotiated on a project-by-project basis.

INDUSTRY STIPEND SCHOLARSHIPS AND TOP-UP SCHOLARSHIPS
Industry stipend scholarships and top-up scholarships can target dedicated full-time or part-time student research projects in particular areas of industry need. Research projects may range from two years (Master by Research) or three to four years (PhD). Scholarship stipends typically cover living expenses and associated costs for students. Scholarship awardees may commence at any time during the year.

TUITION OFFSET SCHOLARSHIPS
The Australian Government and CQUniversity fund a number of tuition offset scholarships for domestic and overseas research higher degree students. In addition, industry partners have the opportunity to sponsor offset places for nominated students to undertake research higher degrees in specified research areas. The industry sponsorship covers all or a part of the cost of a full fee-paying place for the student. Funded place-holders may commence their studies at any time during the year. Many of these students also enjoy the opportunity to work for the industry partner while undertaking their studies.

For further information about sponsoring research or consultancy at CQUniversity please contact the Research Division. Email research-connect@cqu.edu.au or call +61 7 4970 7330.