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2017
Research
Profile



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OF WOLLONGONG
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for purpose

UNIVERSITY OF WOLLONGONG

RESEARCH PROFILE

Driven by discovery

Cover: Distinguished Professor Bert Roberts,
Professor Amanda Lawson, Dr Timothy Cohen
and Professor Zenobia Jacobs.

From 3D bioprinting, materials engineering and medicinal chemistry to social transformation, the University of Wollongong's major research facilities and strengths are working tirelessly to solve complex, real-world problems.

We have developed key research partnerships and collaborations with universities, institutes, governments, corporations and individual researchers around the world. Our institutes bring together world-leading researchers from multiple disciplines, supported by modern infrastructure and an innovative culture.

In the past 15 years our research program has attracted almost \$1 billion in competitive funding for projects that are making an impact on our region, our country and our world every day.

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The University of Wollongong is driving research that makes an impact locally and globally, while helping to create new industries and jobs for the future.

UOW has built an international reputation for world-class research and is proud to be among the best modern universities in the world.

Research improves lives and underpins economic growth. We have established an international network of campuses, partners and bright minds to foster a supportive research community that drives real change.

Research at UOW crosses international and disciplinary boundaries to deliver results. The results of our local and global partnerships between researchers, business, industry and government help build the University's reputation for research excellence.

We've discovered human ancestors, partnered with NASA to find clues to climate change, collaborated with Twitter to manage monsoon flooding responses, built a bionic bra from intelligent fabrics and will invest \$80 million into a Centre of Molecular and Life Sciences that will allow us to move from developing treatments to finding cures. And this is just the start.

UOW invests in excess of \$140 million a year in research. Over the past 20 years we have created the globally recognised research entities of the Australian Institute for Innovative Materials, Early Start, Illawarra Health & Medical Research Institute, SMART Infrastructure Facility, Sustainable Buildings Research Centre and the iAccelerate Centre.

Together with our partners, UOW is delivering global outcomes which are helping solve challenges facing the world.

We maintain our focus on emerging industries and have increased our capacity to commercialise outcomes of our research into services and products nationally and internationally. UOW is supporting the growth of the Illawarra's innovation ecosystem, engaging with industry to drive advanced manufacturing and the introduction of disruptive technologies.

The future is being made right here.

I hope you are impressed and inspired by this glimpse of our research fabric at UOW.

A handwritten signature in black ink, appearing to read 'J Raper', written in a cursive style.

PROFESSOR JUDY RAPER
DEPUTY VICE-CHANCELLOR (RESEARCH AND INNOVATION)

Research with purpose

The University of Wollongong has consistently delivered research of outstanding quality and impact. The dissemination of our research to user communities, including industry, is one of UOW's key goals and we have a strong reputation for our engagement with industry.

RESEARCH INCOME (2016)

- \$53.99m Higher Education Research Data Collection (HERDC) income received in 2015 (based on 2016 return)
- \$36.79m Australian Government Research Block Grant Allocation in 2016
- \$45.91m Australian Research Council (ARC) grant income awarded (for funding commencing in 2017, includes Centres of Excellence, Discovery Early Career Research Award (DECRA), Discovery Projects, Future Fellowships and Linkage Projects (LIEF))
- \$2.08m awarded in 2016 for National Health & Medical Research Council (NHMRC) research grants

COMMERCIALISATION

UOW

- 36 invention disclosures were submitted by UOW researchers
- 5 provisional patents were filed
- 3 patents were granted
- 1 trademark application was granted
- 9 IP licence agreements were executed (UOW technology licensed out to external clients)
- 2 licence options were established (option for external client to license UOW technology)

IACCELERATE

- 87 Startup companies supported by iAccelerate to date (UOW's innovation ecosystem accelerator. The initiative has been running since 2012 and the iAccelerate Centre opened July 2016)
- 57 products have been launched by resident iAccelerate companies
- \$5.4 million reported revenues of iAccelerate resident companies between April to December 2016
- 19 successful applications for IP registrations at iAccelerate

(Figures as at January 2017)

RESEARCH EXCELLENCE

98% of UOW's disciplines that were assessed in Excellence for Research Australia 2015 were rated 'At', 'Above' or 'Well above' world standard. The number of UOW's disciplines rated as 'Well above world standard' has tripled since 2012.

*Based on results at the 4-digit FOR code level.

RESEARCH IMPACT



57,692

Volume of material available on Open Access



26.5

HDR student completions
Per 100 academic FTE



244.2

Scopus publications
(abstract and citation database)
Per 100 academic FTE



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Distinguished Professors

Professor Noel Cressie

Professor Nicholas Dixon

Professor Shi Xue Dou

Professor Buddhima Indraratna

Professor Hua Liu

Professor Antoine van Oijen

Professor Richard Roberts

Professor Anatoly Rozenfeld

Professor Gordon Wallace

Making global impact



The University of
Wollongong is a global
leader in discovery and
learning, working to
transform the world
we live in.

Our medical innovations are improving lives. We are helping to influence public policy. We are creating new ways of thinking about histories and cultures. We are helping prepare for climate change. Most of all, our research is improving social and economic wellbeing in our regional communities, nationally and globally.

Innovation by its very nature is about making significant positive change. It's about leading new ideas and about making impact.

Innovative energy storage

UNIVERSITY OF WOLLONGONG

RESEARCH PROFILE

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UOW is driving research in areas of high-performance lithium-ion batteries, smart battery management for electric vehicles and developing sodium-ion battery technology to help drive the increased use of renewable energy.

The Energy Storage Materials Research Group at UOW's Australian Institute for Innovative Materials (AIIM) is developing materials and technologies for a new generation of energy storage devices that have high energy density, long life cycles and are low in cost.

The race for alternative fuel and green technologies is speeding up worldwide, with the electric drive system for cars, trucks and other transport being the main focus.

UOW's Institute of Superconducting and Electronic Materials (ISEM) has been undertaking electric vehicle research since 2013. Led by Distinguished Professor Shi Xue Dou and Dr Khay Wai See, the team's core research focus is on the development of a system for complete in-vehicle energy monitoring and management.

A major development for the team was the retrofitting of a standard passenger vehicle to be fully battery-powered.

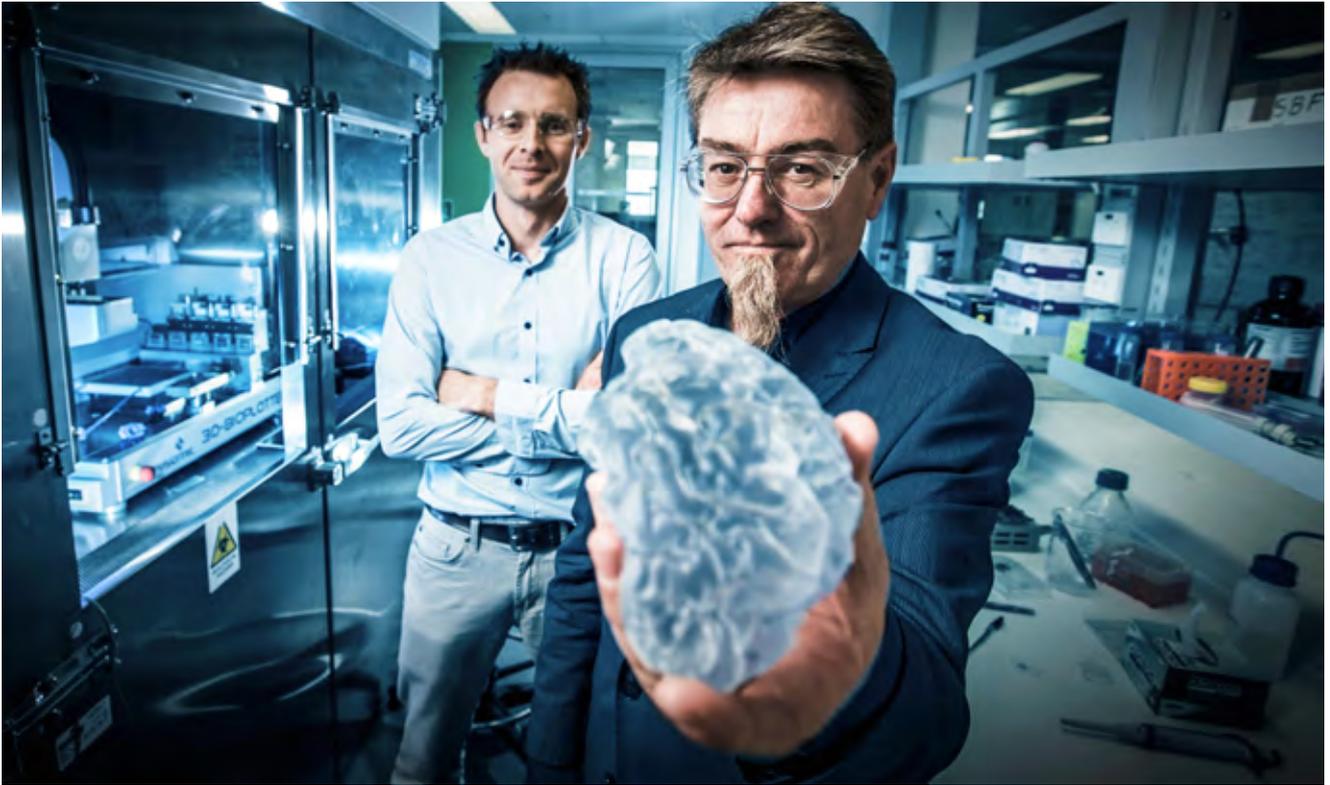
ISEM is also developing a pilot-scale sodium materials production facility to prototype and develop modular and expandable battery packs.

This project has received \$2.7 million from the Australian Renewable Energy Agency (ARENA) and is expected to be completed in early 2020, with UOW research groups from Australian Power Quality and Reliability Centre and the Sustainable Buildings Research Centre working alongside ISEM.

Meantime, an ISEM team led by Distinguished Professor Hua Kun Liu has developed numerous advanced materials and novel techniques for use in lithium batteries, supercapacitors, fuel cells, hydrogen storage, and in hybrid electric vehicles and portable technology devices.

Major contributions by these researchers include the development of strategies to enhance the electrochemical performance of lithium-ion batteries, which are used across portable electronic devices such as laptops and phones, and are increasingly used in transport applications such as hybrid cars.

Left: Distinguished Professor Shi Xue Dou is developing a game-changing sodium battery to help drive increased use of renewable energy.



On the way to building body parts

The University of Wollongong has an international reputation for the strength of its biomedical research and capacity to develop biomaterial devices resulting from its long-standing excellence in materials research.

The work ranges from developing synthetic biosystems, such as nerve regeneration, bionic muscles and implantable devices, to developing devices like the BioPen, which allows surgeons to design customised implants on-site while conducting surgical procedures.

Leading the way is UOW's Institute for Superconducting and Electronic Materials (ISEM) and the Intelligent Polymer Research Institute (IPRI), which is the lead node of the Australian Research Council Centre of Excellence for Electromaterials Science (ACES). This work is making great advancements in areas such as biofabrication – or more commonly known as 3D body printing.

IPRI Research Director Distinguished Professor Gordon Wallace said we are well on the road to printing replacement body parts.

In recent years, the ACES/IPRI team has extended its printing capabilities to bioinks – opening up a new ability to include precisely placed living cells as organised components of 3D bioprint structures.

ACES researchers have also made significant progress developing bench-top brain tissue which may provide critical information on how the brain functions.



CLIMATE MISSION

Our planet is alive and breathing. But it's what it's breathing that has climate scientists worried. The burning of fossil fuels and other human activities are currently adding more than 36 billion tons of carbon dioxide to the atmosphere each year.

In 2014, NASA's Orbiting Carbon Observatory-2 (OCO-2) satellite began its two-year mission to collect data that is helping scientists build a more precise picture of the abundance of carbon dioxide in the atmosphere as well as where it is produced (sources) and stored (sinks).

UOW statistician and Director of the Centre for Environmental Informatics in the National Institute for Applied Statistics Research Australia (NIASRA), Distinguished Professor Noel Cressie, is a member of NASA's satellite mission's science team as a JPL Distinguished Visiting Scientist. He is part of the OCO-2 science team analysing data collected throughout the mission.

UOW's Centre for Atmospheric Chemistry (CAC) is supplying data from ground sites in Wollongong and Darwin to validate the observatory measurements. The ground instruments – monitored by UOW scientists – capture infrared light rays, which are absorbed by carbon dioxide, leaving a unique signature or fingerprint that can be measured to determine the amount of carbon dioxide in the air.

The UOW data is then fed to NASA to give the most precise picture yet of carbon dioxide in the atmosphere, how much is absorbed and where.



DEMENTIA SOLUTIONS

An interdisciplinary team of researchers at UOW are working to create dementia-friendly communities that change the way people with dementia interact within their physical, social and cultural environments.

The Dementia-Friendly Communities and Organisations project – a collaboration between the University's Global Challenges Program, Alzheimer's Australia and Kiama Municipal Council – has helped transform the town of Kiama into a dementia-friendly environment and has won international and national awards. It was recognised at the World Health Organisation's seventh Global Conference of the Alliance for Health Cities. National awards include the National Disability Award for Community Partnerships, and the National Local Government Award for Access and Inclusion.

The project has researchers working with the Kiama Council and the community to improve services such as street signage, retail design and access to transport; reduce the stigma associated with dementia; help local businesses and organisations to become dementia-friendly; and provide education about dementia to the community. Researchers have also developed an interactive website – Our Place – to map dementia friendly places in Kiama.

“By creating communities where people understand dementia, we are enabling those with dementia to live in their communities with meaning, purpose and quality of life,” said Dementia-Friendly Communities and Organisations lead researcher Dr Lyn Phillipson (NHMRC Dementia Fellow) from UOW's Australian Health Services Research Institute and Faculty of Social Sciences.



WEARABLE TECHNOLOGY

Responsive clothing is the new frontier of sports and health technology, with UOW researchers leading the way in solutions that prevent injury and improve comfort.

The Intelligent Knee Sleeve, the Bionic Bra and the Lymph Sleeve are three examples of cutting-edge wearable technologies developed from collaboration among biomechanics, researchers, material scientists, chemists, mechatronic engineers, clinicians, patients and industry.

The Bionic Bra is the world's first responsive bra that senses changes in a woman's breast motion and automatically tightens to provide breast support when needed.

The Intelligent Knee Sleeve provides immediate, individualised feedback to athletes or patients. It alerts them as to whether they are using appropriate knee joint motion when training and playing sports, or when undertaking rehabilitation exercises.

The Lymph Sleeve has the potential to transform the lives of women who suffer from lymphoedema. Developed following a grant from the National Breast Cancer Foundation, the sleeve incorporates artificial muscle technology into a wearable compression garment that gently massages the affected areas. UOW has begun commercialisation of the sleeve.



LIFE-SAVING ONLINE TOOL

A world-first collaboration led by UOW's SMART Infrastructure Facility has had a huge impact on how Jakarta's residents and government agencies prepare for, and respond to, severe monsoonal flooding.

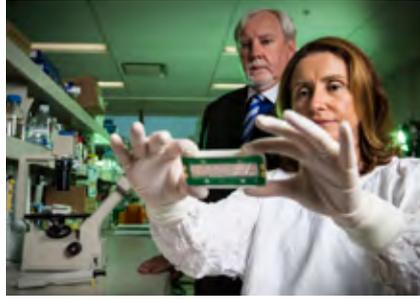
Crowd-sourcing urban data collection project PetaJakarta.org was started with the aid of a Twitter Data Grant, and marked Twitter's first official academic research collaboration using live data. The web-based platform was created to harness the power of social media to gather, sort and display information about flooding for Jakarta residents in real time.

Innovative open source software CogniCity, developed by SMART, allows for information on Jakarta's flooding to be collected and disseminated by community members through their mobile devices. This information is then displayed on a real-time web-based map.

PetaJakarta works with the Jakarta Emergency Management Agency and in 2016 the project, advancing to PetaJakarta 2.0, expanded to include information gleaned from other data sources, such as citizen journalism, government information and river gauges.

PetaJakarta, in partnership with the Government of Jakarta, the Emergency Management Agency and Twitter Inc, was featured in the 2015 World Disasters Report for community-level response to disaster.

The project has also been showcased in the Australian National Data Service eBook about the best Australian research data projects. It has also been commended by the International Federation of Red Cross and Red Crescent Societies, the Open Data Institute, and by the US Government, which described it as an example of best practice for using crowd-sourced information in an emergency situation.



CANCER DRUG HOPE

A new drug developed entirely at UOW for the treatment of metastatic colorectal cancer has been tested on a group of 39 patients, with phase one of the trial now complete.

The trial is a culmination of about 10 years of research by Professor John Bremmer, Professor Philip Clingan and Professor Marie Ranson, who are affiliated with the Illawarra Health and Medical Research Institute (IHMRI), based at UOW's Wollongong campus.

The drug, Deflexifol, has performed very well in pre-clinical testing. Deflexifol was licensed in 2012 to drug company FivePhusion Pty Ltd, which has obtained the necessary approvals to test the drug in humans and has conducted the phase one trial at Southern Medical Day Care Centre. The trial will also soon be available at Liverpool Hospital.

Prof Clingan said the main benefit of Deflexifol is the ability to deliver an effective chemotherapeutic regimen that patients can tolerate over repeated treatment cycles. Prof Ranson said it was very rewarding to see the drug make it from the laboratory bench into the clinic. Phase two of the trials are in development.



RECOVERY CAMP

Recovery Camp is an innovative, evidence-based and award-winning program. It operates as both a professional experience placement for students of preregistration health programs and as a recovery-focused experience for those living with a mental illness.

Since its inception in 2013 – which at the time was an Australian-first – the Recovery Camp team has maintained a focus on research and evaluation.

Attendees engage in a program underpinned by the principles of therapeutic recreation – that is, using recreation activities as a therapeutic means to improve health and quality of life. Activities at Recovery Camp include giant swings, rope courses, rock climbing, flying foxes, bush dancing, Tai Chi, team pursuits, archery and damper making.

The dissemination of Recovery Camp research led to national and international awareness of the Recovery Camp program. Increasingly, universities across the world have expressed their interest in running similar programs.

In 2016, Recovery Camp joined the entrepreneurial start-up program at UOW's iAccelerate Centre. It was the first research program to move from UOW to the iAccelerate Advanced program. This was done to explore the potential of Recovery Camp as an enterprise of social impact.



MAKING SEX SAFER

A biomedical engineer with UOW's Intelligent Polymer Research Institute (IPRI) is leading a small team of researchers who received funding from the Bill & Melinda Gates Foundation to develop a next-generation condom.

Dr Robert Gorkin answered a call from The Gates Foundation in 2013, which highlighted the challenge of reducing the incidence of unplanned pregnancies and preventing sexually transmitted diseases. The foundation's brief asked applicants to come up with a condom that "significantly preserves or enhances pleasure, in order to improve uptake and regular use". In sub-Saharan Africa or South-East Asia, lack of condom use aggravates social, economic and even gender inequalities.

It just so happened that the IPRI labs had already been developing new material called hydrogels as part of their medical bionics research, aimed at more lifelike prosthetics, tissue engineering and implantable medical devices.

Dr Gorkin's proposal, Project GELdom, was one of a handful of applications that won funding of \$US100,000. For projects that show promise there's the possibility of a further \$1 million in Gates Foundation funding.



CLUES TO THE HOBBIT

UOW is involved in globally significant, curiosity-driven research on the origins of Man.

In 2003, the late Professor Mike Morwood, with a team of Australian, Indonesian and international colleagues, announced the discovery of a previously unknown human species – Homo Floresiensis. The remains were found in Ling Bua cave on Flores – an island in eastern Indonesia. The fossil find was dubbed "Hobbit" because of its tiny stature.

This sensational discovery radically challenged the previous theories of human evolution and dispersal across the globe. Following Professor Morwood joining UOW, an ongoing partnership between the Centre for Archaeological Science (CAS) at UOW and the National Centre for Archaeology in Indonesia continues excavating at Liang Bua each year to uncover more clues about the enigmatic Hobbits.

The team used the latest scientific dating techniques to determine that the last surviving population of Hobbits may have persisted long enough to encounter early members of our species as they spread through Southeast Asia to Australia.

Most recently, Dr Gert van den Bergh, also from CAS, led an international team in collaboration with the Geology Museum in Bandung, Indonesia, following Professor Morwood's death in 2013. They excavated a lower right jaw fragment and six teeth from at least one adult and two children of the putative ancestors of the Hobbits, from 700,000-year-old layers of sedimentary rock at a site named Mata Menge, 50km east of Liang Bua.

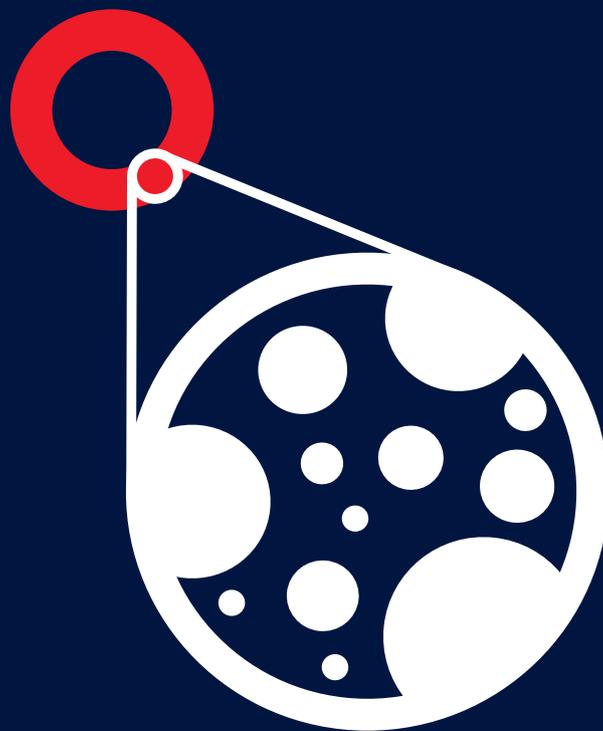
Tackling emerging problems

UOW is a research-intensive university and our reputation as a place for outstanding transdisciplinary research continues to strengthen.

Much of our research is aligned to emerging global problems, from climate change to cybersecurity. We nurture projects, collaborating with industry, government, institutions and other universities to foster a supportive research community and drive social, economic and cultural change.

We champion and demonstrate how an interdisciplinary approach can tackle the significant problems the world faces.

Our research is focused on identifying and meeting the challenges of both today and tomorrow.





UNIVERSITY OF WOLLONGONG

RESEARCH PROFILE



Medical breakthroughs on the horizon

Molecular Horizons: the University of Wollongong's \$80 million Centre of Molecular and Life Sciences was announced in 2016 and will be UOW's biggest ever self-funded research infrastructure investment.

The purpose-built collaborative research centre will be equipped with world-leading technologies, centred around the revolutionary \$7 million Titan Krios cryo-electron microscope. This microscope – one of only a handful in the world and only the second, but most advanced, in Australia – is the world's most powerful and flexible high-resolution electron microscope for biological research. It will allow researchers to see with unprecedented clarity the inner workings of human cells and enable new health-related breakthroughs.

The centre will allow researchers to understand how proteins move and interact over time. This is critical to developing new ways to detect and fight diseases ranging from cancer to Alzheimer's or developing new classes of antibiotics to fight superbugs.

It will house around 150 researchers, including prominent research teams led by internationally renowned Professors Nick Dixon, Antoine van Oijen and Mark Wilson.

The establishment of Molecular Horizons is expected to foster increased collaboration with organisations such as Monash University in Melbourne, the Victor Chang Cardiac Research Institute in Sydney and leading international institutions including Harvard Medical School and Johns Hopkins University in the US. It will also attract and retain some of the best researchers in the molecular science field, while effectively allowing UOW and Australia to forge stronger networks with eminent institutions around the world.

Molecular Horizons is also the centrepiece of UOW's Health and Wellbeing Strategy, which includes a raft of initiatives aimed at harnessing UOW's expertise in medical research, research application and education to address regional and global health challenges.

The centre is expected to open in 2019 and will also build on the success of UOW's Centre for Medical and Molecular Bioscience (CMMB), which brings together a multidisciplinary team of chemists, biologists and medical researchers with a common interest in the molecular basis of disease, disease cure and prevention.

An area that UOW researchers are looking at is antimicrobial resistance. The Australian Government is devising its first National Antimicrobial Resistance Strategy, recommending urgent interdisciplinary research in this area.



Researching solutions for global challenges

UOW's strategic research initiative, the Global Challenges Program (GCP), provides a distinctive environment for collaborative challenge-led research to ultimately transform lives and regions.

The answers to universal dilemmas, such as human ageing or diminishing marine resources, will come from interdisciplinary research that brings world-class researchers together with government, community organisations and business to collectively address our global challenges.

The work of GCP is built around three themes, and one overarching theme, representing complex contemporary issues affecting communities in Australia and around the world.

Transforming Lives and Regions:

The overarching theme of the program recognises the interconnected nature of regional transformation in looking at ways for cities and regions to adapt in a time of social transformation and rapid economic change.

Living Well, Longer:

Ageing and mental health fall under this challenge, bringing together experts in a range of fields including health, engineering, design, social science and finance to look at how we can live well for longer.

Manufacturing Innovation:

We must find clean and innovative solutions for manufacturing. Experts from the fields of engineering, design, economics and social sciences examine the social and cultural impacts of changing technologies on individuals and communities, and how manufacturing can help transform regions.

Sustaining Coastal and Marine Zones:

Half of the world's population, including 66 per cent of Australians, live on the coast. Researchers from the diverse field of science, marine conservation, law, geography, and biology within this theme look at issues such as climate change, preserving vulnerable coastlines and food security.

Global Challenges has supported 73 research projects, with 15 new projects funded in 2016. GCP plays a critical role in developing the next generation of researchers. The program has supported more than 485 investigators since its launch, with 41 per cent of current projects led by female researchers and 25 per cent led by early career researchers.

Direct research funding of \$2.8 million has returned \$19 million in external funding since the launch of Global Challenges in 2013.



Managing mangrove blue carbon

Mangroves play an integral role in many coastal communities. They are also vital carbon sinks, but they are under threat from a number of factors, including coastal development, marine pollution and climate change.

Mangrove forests sequester atmospheric carbon, accumulating in wetland soils over time. Due to regular inundation by saline tides, its release back to the atmosphere is significantly reduced, resulting in the development of a carbon sink.

Destruction of these ecosystems can release the carbon stored in mangrove biomass and soils back in the atmosphere as carbon dioxide or methane.

Blue Carbon Futures (BCF) is a project investigating mangrove blue carbon restoration, conservation and management. It requires a highly interdisciplinary approach and includes a research team of academics and experts in blue carbon biophysical science, law and policy, social and cultural context, and accounting and finance.

The team from UOW – led by Dr Kerrylee Rogers, an environmental scientist and ARC Future Fellow in the Faculty of Science, Medicine and Health – has set out to investigate the social and environmental processes contributing to the decline of mangroves in Vietnam, Brazil and Australia.

Particular emphasis is also given to the use of economic incentives provided to local communities for managing and restoring mangrove forests.

The ongoing aim of the project team is to continue interdisciplinary research into the challenges and opportunities for mangrove carbon sequestration in different spatial and socio-economic settings globally including Australia, Brazil, Vietnam and other Asia-Pacific nations.

Left: Professor Geoffrey Spinks specialises in the development and application of materials for artificial muscles.

Above: Dr Kerrylee Rogers works with response of coastal landscapes and ecosystems to climate change.



Future-proofing our biodiversity and heritage

The University of Wollongong is leading researchers from around the world on a seven-year, \$45.7 million research quest to investigate Australia's unique biodiversity and Indigenous heritage, while inspiring Australian children to engage with science.

The ARC Centre of Excellence for Australian Biodiversity and Heritage (CABAH) will link researchers from science, technology, engineering and maths (STEM) disciplines – including Earth and climate sciences, ecology and genetics – with scholars from humanities, arts and social sciences (HASS) disciplines, such as archaeology, and Indigenous and museum studies.

The first of its kind in the world, the Centre will encourage budding young scientists through a unique outreach program at schools and museums throughout Australia, and will focus on nurturing the careers of Indigenous and female researchers.

CABAH will bring the extraordinary environmental and human history of Australia to the public through a comprehensive program of education, outreach and science communication events for schools, museums, science festivals and a range of digital media.

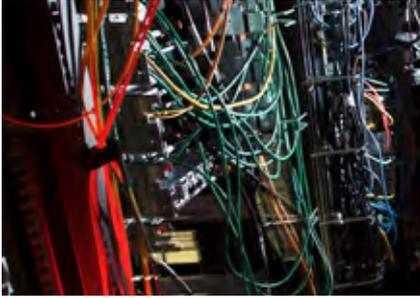
The Centre is led by UOW Distinguished Professor Richard “Bert” Roberts, an ARC Laureate Fellow and the Director of UOW’s Centre for Archaeological Science.

CABAH is funded by a \$33.75 million grant from the ARC, \$1 million from the NSW Government, and \$11 million from participating universities, museums and other organisations.

CABAH works across six research themes that address key questions concerning the human and environmental history of Australia, Papua New Guinea and eastern Indonesia from 130,000 years ago.

Australia’s environmental history and Indigenous heritage are fundamental to understanding the story of human dispersal, adaptations to changing environments and interactions with past landscapes and ecosystems. These lessons will provide the necessary background to managing Australia’s biodiversity and cultural heritage in the future.

Above: Distinguished Professor Bert Roberts, Professor Amanda Lawson, Dr Timothy Cohen and Professor Zenobia Jacobs.



INTERNET OF THINGS

Researchers at UOW are in a unique position to make developments in Internet of Things (IoT) technologies, while also investigating the ethical, political and social issues in society that could potentially arise from it.

Creating smart cities and paving the way toward a smart world, The IoT concept is a network of connected intelligent “things” comprised of smart machines interacting and communicating with other machines, objects, environments and infrastructure.

It has resulted in sensors, lights and meters collecting data to improve infrastructure, create more efficient and cost effective municipal services, enhance public transportation, reduce traffic congestion, and keep residents safe.

UOW’s SMART Infrastructure Facility (SMART) is leading the way in establishing an IoT network in the Illawarra region to enable effective sharing and analysis of data. Partnering with UOW’s Sustainable Buildings Research Centre (SBRC), the IoT Laboratory is a dedicated space for the development of sensor and IoT technologies. Work conducted by the laboratory includes the utilisation of cutting-edge cloud computing and sensor technology to capture essential data on rising water levels. The lab is a member of The Things Network.

Emerging technologies expert Katina Michael is a professor in the School of Computing and Information Technology at UOW. Professor Michael said it is just as important to prepare for technology and how to control it as it is to develop it.



EXPLORING GREEN SPACES

A five-year research project entitled Greener Cities Healthier Lives aims to enhance scientific, industry and policy-maker understandings of the impact of green spaces on health by conducting quantitative public health and social science research.

The partnership between the University of Wollongong’s Population, Wellbeing and Environment Research Lab (PowerLab) and Horticulture Innovation Australia (Hort Innovation), will further research across five key research themes: pregnancy and perinatal health; child health and educational attainment; adult mental health and chronic disease risk; health service use and healthcare costs; and green space preferences and outdoor recreation among seniors.

The project is led by Associate Professor Thomas Astell-Burt and Dr Xiaoqi Feng, two of Australia’s leading green space and public health researchers and co-directors of the PowerLab at UOW.

The PowerLab team will draw on existing and bespoke data as part of the research project, including the study of NAPLAN results to provide the first insights in Australia on green space and educational attainment, longitudinal studies of mental health, and chronic disease in relation to green space and hospital admissions.



QUANTUM COMPUTING

There is much excitement about the global race to develop a quantum computer. But only recently has the warning been sounded that a more important race must be run first – one to prevent this new technology from crippling current cybersecurity methods, which could expose vaults of data to snoops and hackers. With the advent of quantum computers predicted in the decade, we should be very concerned about cybersecurity, and start planning for a more secure future.

The National Institute Standards and Technology (NIST), an agency of the US Department of Commerce, awarded UOW Professor Willy Susilo research funding.

Professor Susilo and his colleagues Dr Thomas Plantard and Dr Guomin Yang have been working on a project to construct algorithms that will remain secure even after quantum computers are built. Professor Susilo aims to submit quantum-resistant cryptographic algorithms to NIST by the end of 2017.

Professor Susilo is one of the few experts in the world who specialise in post-quantum cryptography. He is Director of the Centre for Computer and Information Security Research at UOW and his primary research interest is cryptography, information security and their applications. He has worked closely with Australian Signal Directorate, DST Group and Data61.

Growing our innovation ecosystem



The dissemination of our research to user communities, including industry, is one of UOW's key goals and we have a justifiably strong reputation for our engagement with industry.

Through engagement, we build bridges between academics, businesses and researchers. We learn from each other through sharing knowledge, expertise and skills. These associations are essential for knowledge transfer as they link user needs, long-term research and a clear direction to research outcomes.

UOW is growing the Illawarra's innovation ecosystem and pursuing the uptake of disruptive technologies that deliver positive economic impacts. The nexus between community, business and university is more important than ever as we continue to anticipate the nature of emergent industries and future jobs.

The future is being created here.





At the forefront of an ever-changing world

The Innovation Campus is a 33-hectare beachside research, development and commercial precinct established by UOW to drive partnerships and collaboration between academia and business communities by co-locating commercial and research organisations in state-of-the-art facilities.

It is home to a number of UOW's leading research institutes working in the development of intelligent innovative materials with the potential to regenerate damaged human nerves, the development of superconductors that make energy transmission more efficient, new techniques for sustainable building design, maritime law and security, and innovative approaches to health services delivery and policy.

The campus is a junction for national and international companies, researchers, and students to meet and translate products to commercial success nationally and internationally. It has a well-established community of innovative companies that have steadily grown over the past decade.

One such example is NEC Australia, which officially opened its new corporate office at the Innovation Campus in September 2016, with the operation to create more than 130 new technology jobs and connect UOW students with graduate opportunities with NEC.

Left: The Innovation Campus is a place for knowledge sharing, collaboration and connection between academia and industry.

The Innovation Campus is a significant investment by UOW to drive the economic transformation of the Illawarra by creating jobs and industry, and attracting business, research and investment.

Economic analysis released during 2016 revealed that the University's Innovation Campus activities, separate from UOW, contribute \$195 million to the Illawarra economy each year.

Celebrating its 10 year anniversary in 2016, the Innovation Campus was awarded the Emerging Research Park Award at the Association of University Research Parks (AURP) 2016 Awards for Excellence. The Emerging Research Park Award is presented to an emerging park that has been in operation less than 10 years. Applicants were judged on excelling in bringing technology from the laboratory to economically viable business activities, promoting the growth of businesses and jobs.

The AURP is an international body dedicated to fostering innovation and economic growth in the global economy through university, industry and government partnerships.

UOW's research themes have been refined and translated to key industry sector needs and our Innovation and Commercial Research Unit (ICR) has substantial contact with a diverse collection of businesses.

ICR has its own technology transfer operation to facilitate commercialisation of research. It underlines the increasing importance of the University's research output.

UOW continues to build internal capacity that delivers more open, more rapid transfer of Intellectual Property (IP) to the marketplace.



iAccelerate Centre drives innovation boom

The opening of the iAccelerate Centre in 2016 marked a significant investment by UOW in further developing the innovation ecosystem in the Illawarra and helping the region to adapt and thrive in an ever-changing, globalised future.

The iAccelerate Centre is the Illawarra's purpose-built business incubator and accelerator. Its two-stream program is the first of its kind in Australia.

The Centre supports students, staff and the greater Illawarra community. It provides the infrastructure, mentoring and education programs for great ideas to grow and helps connect entrepreneurs with funding opportunities.

The three-storey, 4,000 square metre building features plug-and-go expandable space for up to 280 entrepreneurs. The Centre helps retain talent locally, giving University graduates the option of local employment and the opportunity to determine their own economic future through entrepreneurship.

UOW is committed to helping grow an innovative region, transitioning the Illawarra from conventional manufacturing to more advanced technology and creating a high-tech industry cluster. The iAccelerate Centre will help the Illawarra become recognised as a leader in technology entrepreneurship, innovation and start-up development.

By December 2016, the Centre had supported 87 start-ups since the initiative was launched in 2011. Since inception, 57 products have been launched by resident companies and another 74 products are under development.

In the nine-month reporting period from April to December 2016, iAccelerate resident companies collectively reported revenues of \$5.4 million, raised \$1.6 million in equity capital, won \$970,000 in grant income and successfully applied for 19 IP registrations (patents, trademarks and registered designs).

Above: The iAccelerate Centre is located at the Innovation Campus.



GREATER COLLABORATION

Small to medium-sized enterprises (SMEs) looking to focus their efforts on knowledge-intensive ICT, shared and financial services, engineering, defence, advanced manufacturing, and health are benefitting from a new program aimed at growing jobs and businesses in the Illawarra and South Coast.

UOW has partnered with the NSW Government to deliver the Advantage SME Program, an initiative funded as part of the NSW Government's Boosting Business Innovation Program. The program is a two-year initiative to support greater collaboration between research organisations and local business.

Advantage SME can assist small to medium enterprises grow and thrive in the global economy.

It provides businesses with access to the capabilities and resources on offer at UOW, including its talented students, leading researchers and advanced laboratories, as well as funding and incentives, such as collaboration vouchers that provide dollar-for-dollar funding to subsidise the cost of commercial research.



DEFENCE TECHNOLOGY

The University of Wollongong is helping link Defence with industry and academia through its strong presence in Defence-related research and training, and maritime security.

UOW was a founding member of the Defence Materials Technology Centre (DMTC) – a national collaborative research centre partnership of defence industry and research providers, which is supported by the Department of Defence. Within the DMTC, UOW draws on its traditional strength in materials engineering (particularly steel research), welding and joining to develop improved armour steels for a range of Defence uses on land and at sea.

DMTC is a joint venture between Defence, industry, universities and government research agencies.

UOW's welding automation group forms a critical part of the estimated \$1.3 billion contract awarded to Thales Australia to supply the Australian Defence Force with 1,100 four-wheel drive vehicles over 3 1/2 years from 2017. The welding group's contribution to naval research and development was recognised with the National Innovation Award at the Pacific 2015 Maritime Exposition.



BUSINESS LINKS

Innovative manufacturers in the region have joined forces with UOW researchers within the Southern Manufacturing Innovation Group (SMIG).

SMIG, a collaboration between UOW's Global Challenges Program and the Innovation and Commercial Research team, was launched in May 2015 to focus on developing innovation through collaboration between businesses and University researchers. The common characteristics of the group are innovativeness, an interest in learning from each other as well as collaborating on projects.

More than 20 companies are now involved with the group and a number of these are exploring collaboration on new product development as a result. It is planned that in the coming year, membership will be expanded. To date, 40 UOW researchers have been connected with local innovative manufacturers.

Apart from the knowledge gained at presentations, there is also active networking before and after these meetings. The success of SMIG so far proves there is definitely a willingness of manufacturing businesses to explore collaborative opportunities and learn more about how to propel the region further.

Empowering communities for food security

For people living in the atolls that make up the Republic of Kiribati, fishing is important for food, income and employment. However, there are fears for the nation's future food-production capacity and food security as sea levels rise and population grows.

Since May 2014, the Australian National Centre for Ocean Resources and Security (ANCORS) at UOW, in partnership with the Government of Kiribati's Ministry of Fisheries and Marine Resource Development (MFMRD), WorldFish, and the Pacific Community (SPC), have been working with Kiribati communities to support the management of the nation's coastal fisheries through the development of Community Based Fisheries Management approaches.

This project, funded by the Australian Centre for International Agricultural Research, has UOW researchers collaborating with their partners to strengthen capacity and empower these communities to manage and develop their fisheries sustainably. UOW is working on five pilot projects in villages across the atolls of Butaritari and North Tarawa.

UOW fisheries governance research fellow Dr Aurelie Delisle said ANCORS teams are working to help residents take charge of fisheries management, by combining traditional knowledge with scientific recommendations.



"Part of the work is about cultural awareness – knowing who to engage and how to engage them," Dr Delisle said. "We've worked with high school students and in environmental classes... fisheries management is being included in the curriculum."

There have also been visits by Vanuatu residents to Kiribati, where they have spoken of the changes they have made to their fisheries practices over 20 years.

"It's what needs to be done – having people at the same level, with the same problem, people community members in Kiribati can relate to, passing on their knowledge," Dr Delisle said.

Above: Kiribati residents are working to take charge of fisheries management, with the help of UOW researchers.



EARLY START

Early Start is one of UOW's research strengths. Researchers and students are engaged in multidisciplinary, evidence-based research across the spectrum of children's academic, physical, cognitive, social and emotional development. Research will have a transformational impact on the lives of children and those who work with and care for them.

Early Start is a first for Australia and a model for the world. It is the Australian showcase for educational innovation, transforming teaching, learning and research.

The Early Start Discovery Space is Australia's only dedicated children's museum, and the first-of-its-kind in the world based on a university campus.

At Early Start, four core elements are closely woven in a deliberate effort to capitalise on the concentration of expertise and to drive innovation. These are Early Start's research, the Early Start Discovery Space, the innovative teaching programs and the 41 Early Start Engagement Centres.

As part of the partnerships, each Early Start Engagement Centre is provided with a University-supported technology bundle. The technology facilitates the delivery of high quality professional development for education, the translation of research outcomes into practice and day-to-day enhancement of child development and learning through virtual visitation programs and activities.

The Early Start Engagement Centres are at the heart of Early Start as they serve some of the most vulnerable families across regional and remote NSW and ACT.



ADDITIVE MANUFACTURING

The potential of 3D printing to change the fabric of Australia's manufacturing identity and mitigate industrial decline is explored in the Global Challenges project: Re-energising the Illawarra through Additive Manufacturing.

Researchers and students work and study in close collaboration with industry partners to transfer latest additive manufacturing knowledge. The team also identifies realistic and sustainable ways to tap into the skills of the existing workforce and create new supply chains.

Such work enables industrial regions such as the Illawarra to reconsider how they approach the future of manufacturing. These themes can be translated to manufacturing-heavy cities throughout the world.

On a micro level, 3D printing could lead to the creation of niche industries and products, providing an outlet for creativity and specialist skills.

The Global Challenges project, 3D Printed Fins for Surfboards, is helping to create custom-designed 3D printed fins that allow surfers to improve their performance. The team has been working with Illawarra surf brands, local intermediate and advanced surfers, and one international surfer on the pro-tour circuit.



ONLINE COURSES

UOW is providing three Massive Open Online Courses (MOOCS) via global online learning platform FutureLearn that cover a wide range of disciplines.

The FutureLearn partnership gives UOW an even broader opportunity to bring our world-class research and our research-led learning to an international audience.

The courses offered are:

- Bioprinting: 3D Printing Body Parts. Run by the Australian Institute for Innovative Materials at UOW, students discover how biomaterials and 3D printing collide to create revolutionary body parts.
- Homo Floresiensis Uncovered: The Science of The Hobbit. This course has been developed by the Centre for Archaeological Science (CAS) at UOW in association with the Indonesian National Research Centre for Archaeology (ARKENAS), and Lakehead University, Canada.
- Preventing Childhood Obesity: an Early Start to Healthy Living. This course follows the latest innovative research in childhood development, and offers learners the opportunity to gain insights from well-respected and published professionals about obesity prevention in children under five, and gain lifestyle strategies to provide children with an early start to healthy living.

Women of impact

The UOW Women of Impact initiative was launched in July 2016 to celebrate the contribution of women academics at UOW.

Researchers focused on solving complex world challenges, academics advancing knowledge in fast-moving industries and teachers passionately mentoring a new generation were among researchers recognised as UOW Women of Impact.



Female academics at UOW are undertaking vital research that is critical to Australia's future.

This initiative is designed to further enhance the public profile of research and teaching at UOW and was inspired by the University's participation in the Science in Australia Gender Equity (SAGE) pilot. This is based on the successful UK program Athena SWAN, an accreditation and improvement program that recognises commitment to advancing women's careers in these traditionally male-dominated disciplines.

The UOW Women of Impact profiles can be viewed at uow.edu.au/research/woi



A social connection

**ASSOCIATE PROFESSOR
MELANIE RANDLE**

Making a difference in the lives of society's most vulnerable people is what motivates Associate Professor Melanie Randle.

After completing a PhD in marketing on attracting volunteers, Professor Randle was employed as a research associate for a new project being conducted with local foster care organisations struggling to recruit enough carers for the number of children requiring foster homes.

Together with a multidisciplinary team of researchers from marketing, psychology and creative arts, as well as practitioners from three local non-profit organisations, the \$480,000 Australian Research Council-funded study investigated how marketing concepts can be used more effectively to increase the recruitment and retention of foster carers.

This project was the beginning of a close research association between Randle and local social service organisations, which continues to this day. Over the next four years, she will lead an ARC Linkage project examining changes in perceived consumer value of disability services following the implementation of the National Disability Insurance Scheme (NDIS). She will work with two local non-profit organisations that are faced with the challenge of operating in a newly competitive marketplace for disability service provision and having to compete with for-profit service providers.

"I feel fortunate to have a job which allows me to pursue the research topics that are of interest to me and gives me the flexibility to combine my responsibilities as a mother of four children with full-time work."



Associate Professor Sarah O'Shea
EDUCATIONAL EQUITY

An ongoing and substantive contribution to educational equity has been the hallmark of Associate Professor Sarah O'Shea's work at UOW.

Professor O'Shea, from the School of Education, has set her goal to improve university outcomes for diverse learners.

Nationally, Professor O'Shea leads research that focuses on higher education participation among equity groups – including students from low socio-economic status backgrounds and Indigenous students. She also focuses on those who are regarded as being at-risk of attrition such as first-in-family students, 'second chance' learners and Indigenous students.

Her institutional and nationally funded research studies advance understanding of how under-represented student cohorts navigate the transition into the university environment, manage competing identities and negotiate aspirations for self and others.

Professor O'Shea has more than 20 years of teaching experience across a variety of adult education contexts, providing academic skills support to diverse student populations before moving into an academic role to further her research output.

"This diverse background has provided me with a unique insight into the nature of the university student experience and prompted my PhD (2009), which qualitatively explored how older female learners, all of whom were first in their family to attend university, managed their transition into this environment, among many competing demands," she said.



Dr Helen McGregor
CLIMATE CHAMPION

Revealing the significance of the human-climate-environment interaction is the research focus of Australian Research Council Future Fellow Dr Helen McGregor.

One of Dr McGregor's major contributions to climate change science so far has been to document for the first time, profound seasonal-scale changes in past El Niño behaviour, providing insight to ocean-atmosphere interactions that are critical to the success of predictive models of global climate change.

She was invited to co-lead Phase 1 of the Ocean2k project (2011-2015) and was lead author on the resulting 2015 Nature Geoscience article, the first study to produce an ocean-only synthesis of temperatures for the past 2,000 years. She is now overall lead of Phase 2 of the Ocean2k Project.

Dr McGregor's work has also led to outstanding contributions in the understanding of the regional context of climate change and its impacts on sea level, ecosystems and humans. Her research substantially advanced our knowledge of how highly productive coastal upwelling zones respond to global warming. Published in the journal Science, the research has implications for marine ecosystems that sustain approximately 20 per cent of the world's fisheries.

As co-organiser of the 2015 Global Climate Change Week, Dr McGregor was instrumental in fostering greater understanding of climate change action and solutions.



Professor Elena Pereloma
STRUCK FROM STEEL

One of just a handful of women metallurgy professors in the country, Professor Elena Pereloma looks to the past and the future for inspiration.

Professor Pereloma is at the forefront of fundamental research to understand the properties of materials at the micro- and atomic scales using electron microscopy and atom probe tomography. Her findings have been applied in industry to improve the strength and sustainability of steel and titanium products.

Forging a career from the shadow of her father and grandfather, both highly regarded metallurgists, Professor Pereloma has carved her own success in research, teaching and industry collaboration. Among her achievements is the establishment of the Electron Microscopy Centre at UOW, which is home to one of the country's most advanced scanning transmission electron microscopes.

In 2015, she led a team that was awarded almost \$1 million by the Australian Research Council to add a focused ion beam microscope equipped with a secondary ion mass spectrometer to the Electron Microscopy Centre's arsenal.

"The driving force behind my career is the wonder of discovery – opening pathways to finding proofs for long ago proposed theories using atomic level information and applying this to optimising the design of steels and alloys."

Finding solutions together

We understand that to truly make a difference to the world our research needs to be conducted with a global perspective.

UOW maintains and continues to grow key research partnerships and collaborations with universities, institutes, businesses, government organisations and individual researchers across Australia and around the world.

The co-location of research activity with partners across UOW's campuses in NSW and abroad is a strong driver of regional innovation.

This partner-driven research works towards solving the world's toughest problems.





Keeping our steel industry strong

Australia's proud standing as a world-class steel manufacturer is under threat due to a range of economic factors, both global and domestic. By drawing on the combined capacity of leading universities and the steel industry, UOW's Steel Research Hub delivers manufacturing innovations that will ensure the industry's global competitiveness.

The Australian Research Council (ARC) Research Hub for Australian Steel Manufacturing, based at UOW, is focused on research and development programs that address manufacturing techniques and processes, innovation in new products and best-practice pathways for bringing new ideas to market.

It brings together the best and brightest engineers and scientists from Australia's steel manufacturers and research institutions to drive industry innovation in product development and improve global competitiveness.

Under the umbrella of the ARC Research Hub for Australian Steel Manufacturing (Steel Research Hub), UOW is currently engaged in the following three programs:

- **Market-focused product innovation:** Improved abrasion resistant and high-strength Q&T steels; steel-intensive, mid-rise residential building designs and anti-fungal coatings for steel surfaces.
- **Innovative coatings technologies:** Innovative coatings technologies for existing BlueScope coatings and processes.
- **Sustainable steel manufacturing:** Involving researchers from UQ, the University of Newcastle and Monash University, this program covers a broad array of projects focused on environmentally and economically sustainable steel and iron manufacturing for BlueScope and Arrium.

Product innovations include a project to develop a self-cleaning, anti-fungal organic coating for painted sheet steel to prevent the build-up of mould, algae and other bacteria on coated steel products, particularly in humid environments.

The hub's key research partners are a unique grouping, representing a cross-section of the Australian steel industry, from raw materials through to the end-user SMEs. These partners include BlueScope, Arrium (represented by OneSteel), the Australian Steel Institute, Bisalloy, Cox Architects, Lysaght and Stockland.

The partnership with BlueScope is particularly strong, as UOW was the education college that was originally established to service the steel industry. The need to train technical staff for BHP's Port Kembla Steelworks was one of the prime reasons for the establishment in 1951 of a Wollongong division of the NSW University of Technology.

Above: UOW has a strong partnership with BlueScope.

Fighting against diabetes risk

About 280 Australians develop diabetes every day, and the spotlight is on western Sydney, where incidence is among the highest in the country.

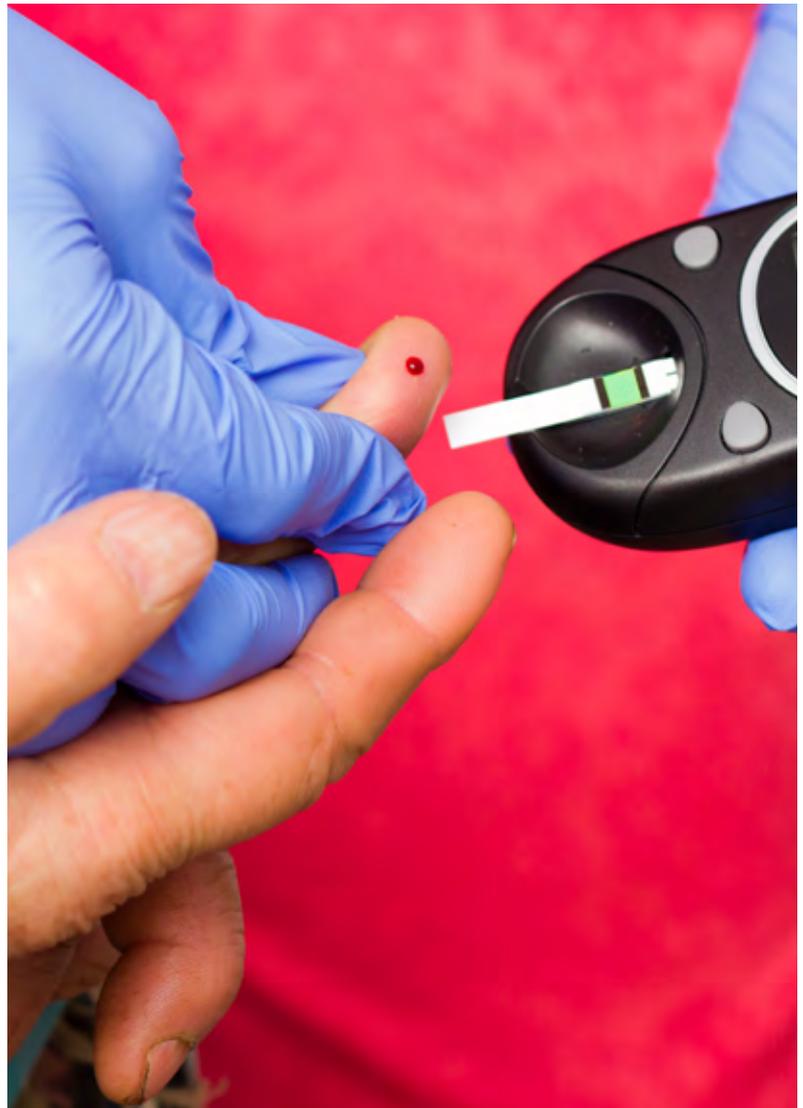
UOW researchers Associate Professor Thomas Astell-Burt and Dr Xiaoqi Feng, members of the Western Sydney Diabetes Prevention and Management Initiative, are in charge of one of the world's largest studies into environmental factors that may contribute to successful management of the disease.

According to Dr Astell-Burt, the prevalence of diabetes in Sydney's west is between six to eight per cent of the population compared with only two per cent in more affluent areas in the eastern suburbs and north shore.

"We have researched this since 2012, with incredible support from Western Sydney Local Health District (WSLHD) and WentWest Primary Health Network. We found we have this wide inequity within our city which we think may be driven by the environments we live in," Dr Astell-Burt said.

Dr Feng is a senior lecturer in epidemiology at the University of Wollongong, who also received a postdoctoral fellowship from the National Heart Foundation of Australia to conduct related research on diabetes prevention with WSLHD.

The project aims to bolster collaborations with health policymakers and urban planners to improve the quality of neighbourhoods.





REDUCING UPKEEP COSTS OF AUSTRALIA'S RAIL NETWORK

Rail transport is a critical component of Australia's economic future, in particular through the movement of natural resources such as coal and iron ore.

Yet some ballasted rail tracks in many parts of the country lack the capacity to support the increasingly heavier and faster trains associated with the industry. Tracks are also subject to degradation and the infiltration of fine particles such as coal dust.

UOW's Professor Buddhima Indraratna and his team at the ARC Centre of Excellence in Geotechnical Science and Engineering are integrating their research work into real world applications, helping solve problems in transport infrastructure.

As Chief Investigator on nine ARC Linkage grants in the last 10 years – the most recent awarded in January 2017 – Professor Indraratna is a keeper of the key to successful collaboration with industry. He is one of Australia's foremost experts on railway infrastructure and the Foundation Director of the Centre for Geomechanics and Railway Engineering, Australia's first track research centre.

The research Professor Indraratna and his team have undertaken has revolutionised the field in terms of design innovations and extended longevity, enabling faster trains carrying heavier loads. It has also positively influenced Australian practices over the years, particularly in the revision of existing Australian standards.

In key projects, his team collaborates with a number of industry organisations including Australian Rail Track Corporation Ltd., Aurizon, Coffey Geotechnics, Douglas Partners and Menard Bachy.

Presently, Professor Indraratna is examining the factors that cause mud pumping on rail lines and evaluating the effectiveness of draining to prevent the problem. Mud pumping occurs particularly in areas where the ground is waterlogged and causes millions of dollars of damage to Australia's rail network every year.

Researchers conduct large scale experimental work in their UOW laboratory that practically captures what happens in the field, combining with expertise in predictive computer simulations. Solutions examined include utilising geosynthetics such as polymer geogrids, geocomposite, geocells and rubber mats.



WORKING TOGETHER TO IMPROVE MENTAL HEALTH

Each year, almost one in five Australians experiences a mental illness. Research indicates that people in regional and remote areas are less likely to seek help for mental illness than their metro counterparts and help may be less available to them.

The new purpose-built \$2.5 million Mental Illness in Nowra District: Goals and Prevention (MIND the GaP) facility is a joint initiative of the University of Wollongong, Shoalhaven City Council and the Commonwealth Government that will help address the high level of mental health needs in the Shoalhaven, particularly among vulnerable and younger people.

Research into clinical practice in a regional context forms a critical part of the delivery of the MIND the GaP initiative. Research focus will be across three intersecting domains of suicide prevention, traumatic stress responses and community resilience.

The initiative, which is jointly funded by the Commonwealth Government's National Stronger Regions Fund and the University of Wollongong, will be led by Shoalhaven City Council and the University of Wollongong, and delivered in partnership with Lifeline South Coast, Lifeline Australia Research Foundation, Coordinare, Nowra Medicare Local, the Illawarra and Shoalhaven Local Health District, Noah's Shoalhaven, and the Illawarra Health and Medical Research Institute (IHMRI).



CONNECTING GLOBALLY

Established in 2011, the Universities Global Partnership Network (UGPN) is an international consortium of selected research-intensive universities focused on turning ideas into action by developing sustainable world-class research, education and knowledge transfer. UOW joined the network in November 2015.

UOW partnered with other like-minded universities within the UGPN network to ensure it continues to grow as an international institution and increase its global impact.

The 2016 UGPN annual conference was held at UOW and attendees declared the Wollongong event as the best ever. The conference, which included presentations, workshops, tours and networking events, drew approximately 85 attendees from UGPN partners and UOW.

To foster an innovative research culture, the UGPN has created the Research Collaboration Fund (RCF) where partners from the University of Wollongong, University of Surrey, North Carolina State University and the University of São Paulo apply to fund high quality bilateral, trilateral and quadrilateral research projects.

Each project is investigating an exciting new area of research and providing opportunities for staff and students to visit partner institutions.

BAOSTEEL LINK

The University of Wollongong has forged a partnership since 2007 with the Chinese Government-owned Baosteel, China's largest steel company and the world's second largest producer of steel measured by annual tonnage.

UOW was the first foreign university to undertake research and development activities with Baosteel. The University is also one of the four Australian partner universities of the \$25 million Baosteel-Australia Joint Research Centre.

The centre seeks to create fundamental knowledge and exploitable technologies with commercial relevance to steel industry. It focuses on metallurgy and new materials, energy utilisation, environmental sustainability and other new technologies.

The University participates in commercial research projects in not only Baosteel's traditional business of steel manufacturing and processes, but also in new materials for energy storage and efficiency improvement.

The Energy Conservation Group at UOW's Institute for Superconducting and Electronic Materials (ISEM), in collaboration with BaoSteel and other partners, is working to improve the energy efficiency of steel plants by developing new ways to capture heat from the steel-making process and convert it to usable energy.

SCHIZOPHRENIA STUDIES

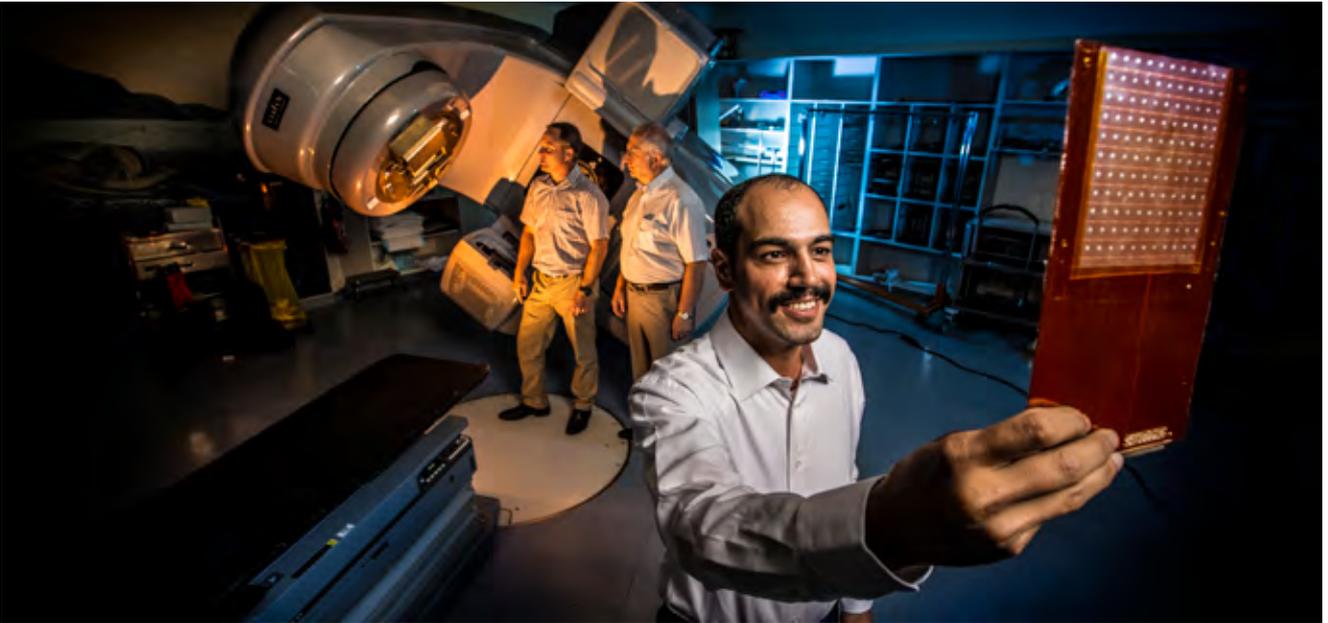
The cause of schizophrenia is not very well understood but believed to involve both genetic and brain developments.

Professor Xu-Feng Huang is Director of UOW's Centre for Translational Neuroscience, and Deputy Scientific Director at the Illawarra Health and Medical Research Institute (IHMRI). He is investigating some of the ways and means to prevent and treat schizophrenia, obesity and related metabolic disorders.

A recent NHMRC-funded Australia-China research project to understand the link between a particular gene (known as neuregulin-1) and schizophrenia has revealed some exciting insights. This project involved the genetic analysis of more than 1000 patients in the Beijing Psychiatric Unit in China, where Professor Huang and his team discovered that a slight alteration of the neuregulin-1 gene affects brain development.

Professor Huang is also collaborating with a team at the Intelligent Polymer Research Institute (IPRI) to develop a process of reinstalling and repairing the function of that gene using nano-technology.

Meantime, Professor Huang has also found evidence that saturated fatty acids in diet induce brain inflammation and impair the leptin signalling pathways that regulate appetite.



Making cancer treatment safer

Centre for Medical Radiation Physics (CMRP) researchers at UOW have collaborated with NASA scientists to develop instrumentation for measuring the radiobiological effects of cosmic radiation on humans.

These researchers are also working with leading radiation oncology institutes around the world on groundbreaking cancer treatments.

CMRP Director Anatoly Rozenfeld and his team have developed a deeper understanding of the field of radiobiology, inventing and patenting tools for measuring the dosage in radiation therapy.

Affiliated with the Illawarra Health and Medical Research Institute (IHMRI), CMRP is a world-leader in the development of semiconductor sensors for radiation dosimetry and microdosimetry, particularly for radiation therapy.

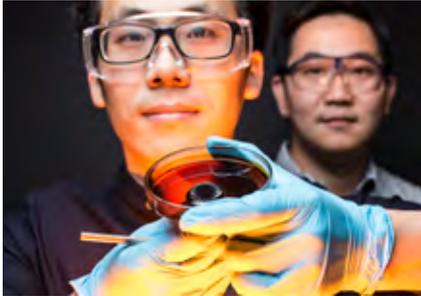
“At the moment patients are all getting the same radiation therapy treatment. Yet every single person’s body is different and we need to understand the biological peculiarities so the treatment is tailored to the patient,” Professor Rozenfeld said.

One of the new frontiers to open up in cancer treatment is charged particle therapy which uses protons or heavy ions, as opposed to traditional X-rays.

The CMRP has pioneered proton therapy research in Australia since 1999 and patented a solid-state device to measure Radiobiological Efficiency (RBE). It is also considered an innovator in the field of microdosimetry, where CMRP researchers have established collaborations with heavy ion therapy facilities in Japan, allowing UOW to share research, facilities and training.

Meantime, a silicon microdosimeter developed by CRMP that improves the assessment of risk in mixed radiation fields, typically in avionic and space radiation environments, has been granted a patent in the United States. The silicon-based device is an essential contribution to radiation protection of pilots and astronauts where the radiation environment is not easy to predict.

Above: Dr Ziyad Alrowalli holds “The Magic Plate” at Wollongong Hospital’s Illawarra Cancer Care Centre in the linear accelerator treatment room.



BEIHANG UNIVERSITY

China's leading engineering research university, Beihang University (BUAA) is a strategic international partner with the University of Wollongong.

This partnership enables the two universities to collaborate on challenges with the rapid transformation of global manufacturing and the development of environmentally friendly technologies.

A formal partnership with Beihang University was established in 2009 with a PhD scholarship program jointly sponsored by the University of Wollongong and the Chinese Scholarship Council (CSC).

In 2014, a Joint Research Centre was established in the area of Advanced Material Science and Technology, with research collaborations achieving excellent results. The collaboration between UOW and BUAA was further strengthened in 2015 with the signing of an undergraduate student exchange program.

Research fellow Dr Yi Du, from UOW's ISEM, and partners at Beihang are actively researching new dimensions in materials science to build next generation computing, electronics and smart materials for sophisticated sensors and drug delivery systems.

Within this work, they have demonstrated two novel methods of controlling the movement of droplets of oil within other liquids using magnetic forces. The two techniques have major implications for environmental protection, as well as protective coatings for drug delivery.



MTR HONG KONG

The University of Wollongong's SMART Infrastructure Facility assists industry and government organisations to better understand their planning and management options.

The facility has built an international profile working with government agencies in Australia and around the world, and has created a large network of global collaborations to address some of the big challenges in infrastructure.

Hong Kong's MTR Corporation has commissioned SMART to investigate how social media chatter can be captured and used to boost innovation and customer service.

This research project will assist the world-renowned rail service provider to develop strategies for harnessing information published by commuters on social networks such as Twitter, Weibo, WeChat and Facebook to allow staff to better allocate tasks for immediate action or review.

SMART, a respected partner and leader in the space of geosocial intelligence (GSI), will custom-build a platform to suit MTR's needs.

UOW has also trained senior staff within MTR-HK for over 10 years through a tailored Masters program in Asset Management, with interdisciplinary skills in both engineering and management.



BETTER BUILDINGS

UOW's Sustainable Buildings Research Centre (SBRC) is a research participant in the Cooperative Research Centre for Low Carbon Living (CRCLCL). Our engineers and built environment researchers have joined five other partner universities and 48 industry and government participants in a two-year project to lower carbon emissions in the Australian built environment and deliver competitive advantage for industry.

The Sustainable Buildings Research Centre (SBRC), based at UOW's Innovation Campus, has also been working closely with BlueScope since its inception on the development and evaluation of new steel sustainable building products.

One of these joint projects was the development of the Team UOW-BlueScope Solar Assisted Heating Ventilation and Cooling (HVAC) system, which was demonstrated on a retrofitted, modular, net zero-energy Australian fibro home entered by Team UOW in the Solar Decathlon. Team UOW was the first Australian team to gain entry to any Solar Decathlon, and took out first prize.

SBRC's collaborations provide an exchange of ideas and expertise in areas including the development of sustainable building technologies for residential and commercial applications, the analysis and improvement of thermal design for buildings, and developing control and sensor technology to improve building performance.



UOW Research

UOW actively engages locally and globally with industry and government to transfer research and outcomes into services and products.

RESEARCH STRENGTHS

- Advanced Manufacturing Technologies
- Australian Centre for Cultural Environmental Research
- Australian National Centre for Ocean Resources and Security
- Centre for Archaeological Sciences
- Centre for Medical and Molecular Bioscience
- Centre for Medical Radiation Physics
- Early Start Research Institute
- Engineering Materials
- GeoQuEST
- National Institute for Applied Statistical Research Australia

MAJOR RESEARCH ENTITIES

- Australian Institute for Innovative Materials
- Early Start
- Illawarra Health and Medical Research Institute
- SMART Infrastructure Facility
- Sustainable Buildings Research Centre

EXTERNALLY FUNDED CENTRES

- ARC Centre of Excellence for Electromaterials Science (ACES)
- ARC Centre of Excellence for Australian Biodiversity and Heritage (CABAH)
- ARC Centre of Excellence in Geotechnical Science and Engineering (GSE)
- Australian Centre for Electromagnetic Bioeffects Research
- Australian Power Quality and Reliability Centre (APQRC)
- ARC Research Hub for Australian Steel Manufacturing
- Centre for Geomechanics and Railway Engineering
- Centre for Human and Applied Physiology
- Defence Materials Technology Centre (DMTC)

COOPERATIVE RESEARCH CENTRES

- Automotive CRC
- Bushfire CRC
- Capital Markets CRC
- Energy Pipelines CRC
- CRC for Polymers



The University of Wollongong has become a benchmark for Australia's new generation of universities within just over 40 years as an independent institution.

UOW's student population is diverse, consisting of 143 nationalities among its student enrolment of more than 32,000. UOW is an international network of campuses and regional learning centres, with more than 13,000 students enrolled at the University's off-shore locations. Our nine domestic locations are Wollongong campus, Innovation Campus, Southern Sydney, Bega, Batemans Bay, Shoalhaven, Southern Highlands, Sydney Business School and South Western Sydney.

UOW's 134,000 alumni live and work in 175 countries across the world. Our graduates are well respected, with UOW being ranked among the top one per cent of universities in the world by employers.

272 INSTITUTIONS

Academic/Research collaborations (formal links).

1,398 UOW GLOBAL COLLABORATIONS IN 2016

(including publications with international co-authors, grants with international investigators and contract research with international funding partners).

ONE OF THE WORLD'S BEST MODERN UNIVERSITIES

- 12th in the world - QS Top 50 Under 50 Rankings 2016
- 30th in the world - Times Higher Education Young University Rankings 2017

TOP 2% OF UNIVERSITIES IN THE WORLD

- 218th in the world - QS World University Rankings 2016/2017
- 251-300 band - Times Higher Education World University Rankings 2016/2017
- 301-400 band - Academic Ranking of World Universities (ARWU) 2016
- 313th in the world - U.S. News Best Global Universities Ranking 2017
- 264th in the world for research quality - 2016 Leiden Ranking

5-STAR RATED UNIVERSITY

- 5-Star rating - QS World University Rankings 2016

A TRULY INTERNATIONAL UNIVERSITY

- Ranked 71st of the top 200 most international universities in the world - Times Higher Education World University Rankings 2015/2016

CONTACT

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