Minister the Hon Dan Tehan MP visits ANU campus.
The Australian National University was established in 1946 with a special charter – to give the nation a world-class research capacity in subject areas which were going to be important for the nation’s future.

As the nation’s university, ANU delivers research and scholarships that contribute to advancing Australia and the region. The Australian Government has supported this unique mission through the National Institutes Grant since the University’s foundation in recognition of its role as a resource of national significance.

The National Institutes Grant is the critical investment that establishes the University’s capacity as a nationally and internationally significant research institution. It allows ANU to maintain and enhance distinctive concentrations of excellence in research in areas of national importance and at the level of excellence Australians expect. The National Institutes Grant helps develop our national unity and identity, and engage with our Indigenous and non-Indigenous history and culture, as well as modern Australia’s place in the world. It allows ANU to serve Australia in public policy, developing evidence-based solutions to address major issues confronting governments, business and communities. Finally, the National Institutes Grant enables access to world-class facilities and infrastructure and a high-quality training ground for future research and academic leaders.

The ANU National Institutes Grant Framework governs the expenditure and accountability of the National Institutes Grant to ensure its purpose continues to be its guide. The framework strengthens the strategic focus that underpins expenditure of the National Institutes Grant within ANU; enhances accountability for, and transparency around, that expenditure; enables ANU to remain flexible and agile to meet new and emerging strategic and national priorities; promotes the uniqueness of ANU as Australia’s national university and our ability to expertly deliver on key activities of national significance; and demonstrates an outstanding benefit to the nation because of the University’s distinctive excellence.

This National Institutes Grant Report 2018 highlights, through stories, some of the ways the National Institutes Grant allows ANU to make unique contributions in the areas of Indigenous Australia, the Asia-Pacific region, public policy, excellence in research and innovation, and protecting the future of research.

For further information regarding the National Institutes Grant at ANU, please refer to www.anu.edu.au/about/national-institutes-grant
Contributing to Indigenous Australia

The National Institutes Grant enables ANU to support the development of Australia’s national unity and identity, including by improving Australia’s understanding of itself and the history and culture of its Indigenous peoples.

First Nations Governance Forum

A simple, but critical, question faces our nation:

“What place should our First Nations Peoples hold in the structures that define the modern Australian state?”

This question has a long and complicated history and no easy answer. Yet the answer tells us the type of society we want to be. As Australia’s national university, ANU has an obligation to constructively contribute to the discussion of legal and policy reform of significant issues concerning Indigenous Australia.

In July 2018, ANU held the First Nations Governance Forum to rekindle the stalled debate on the place of First Nations peoples in the imagination of contemporary Australia. The forum was designed to help our nation take an important step forward in answering our morally simple question.

The forum created momentum to move beyond our past and begin working to furnish a better future for all Australians. The First Nations Governance Forum not only internationalised this issue, it revived the process and public interest in the topic of recognition, leading to greater engagement with remote Indigenous communities, and enhancing access to education, ‘know how’ and support for expertise. Students are now showing more interest in programs such as the University’s Indigenous studies program.

Following on from the forum, ANU presented the Faith Bandler Lecture, a public lecture by Geoffrey Robertson AO QC on the advancement of the rights of Aboriginal and Torres Strait Islander peoples. The lecture drew more than 900 attendees. In 2019 and 2020 ANU intends to host a series of forums that look at the treaty formation process and the substantive content of treaties, involving community elders and various levels of government and politics.

Restoring Indigenous cultural heritage

The Riverina stone artefact project is an endeavour to preserve ancient Aboriginal artefacts uncovered on farmland and, in some cases, kept in secret for generations. ANU researchers from the Research School of Humanities and the Arts are working with local Wiradjuri Indigenous communities, regional museums and the farming community. They completed a survey of Indigenous material culture in the collections of small local
museums in the Riverina district in early 2018. A subsequent two-day national symposium, The Gift of Stone, brought together researchers, museum curators, cultural heritage workers, artists and farmers from across Australia to share information and discuss the design and planning of the next stage of the project, Talking about Stones. Conversations on concepts of a shared history and heritage, at specific, local and personal scales, between settler and Indigenous community members have had one of the biggest impacts of this project to date. Information sharing days for Talking about Stones have particularly nurtured group discussions and individual conversations about shared experiences of living on, caring for, and learning from country. The other major area of impact thus far is through engaging the small local museums on their holdings, and representation, of Indigenous culture. This ongoing dialogue develops awareness, as well as resources and skills, which will have a broader community impact. While working closely with the three museums in the trial, the project visited more than 30 museums in the Riverina and continues to talk to them about the project’s development.

**Honour for inaugural ANU Indigenous Australian Postdoctoral Fellow**

ANU academic Dr Virginia Marshall, Australia’s leading legal scholar on Aboriginal water rights and interests, was this year honoured by Canada’s University of Victoria for outstanding research achievements by a female scholar. The University of Victoria conferred the Distinguished Women Scholars Award on Dr Marshall and invited her to deliver the Distinguished Women Scholars Lecture at their university earlier this year, in recognition of her research on Aboriginal water property rights and interests in Australia.

**Research into Aboriginal and Torres Strait Islander health and wellbeing**

The Aboriginal and Torres Strait Islander Health Program (ATSIHP) in the ANU College of Health and Medicine aims to build bodies of research into Aboriginal health and wellbeing. This much-needed research would mix quantitative and qualitative methods, and be engineered and carried out by Aboriginal and Torres Strait Islander staff. The ATSIHP team of 36 people – half being Aboriginal and/or Torres Strait Islander – is working on studies of national importance. The Mayi Kuwayu Study is investigating how Indigenous health is linked to factors such as connection to country, cultural practices, spirituality and language use – something that hasn’t been studied in Australia before. The study on reducing cardiovascular disease (CVD) in Aboriginal and Torres Strait Islander people has influenced Australian Government CVD prevention strategies. For example, changes are being considered to the Medicare Benefits Scheme to incentivise screening for CVD in non-Indigenous and Aboriginal and Torres Strait Islander peoples. The need for earlier screening is now reflected in all major guideline developers across Australia agreeing to recommend Aboriginal and Torres Strait Islander screening for CVD from age 18 years.

**Supporting the Department of the Prime Minister and Cabinet**

The ANU Centre for Aboriginal Economic Policy Research (CAEPR) has a long-standing collaborative research partnership with the Australian Government Department of the Prime Minister and Cabinet (PM&C). Over the last 12 months, CAEPR researchers have provided analysis and interpretation of the 2016 Census to PM&C and other Australian Government departments and entities. This research has fed directly into the Closing the Gap Refresh, PM&C’s review of their overarching policy framework for Indigenous Affairs. CAEPR’s work on the drivers of population growth has been praised as challenging the way we all think about Aboriginal population growth.
Contributing to Australia’s understanding of, and role in, Asia and the Pacific

The National Institutes Grant enables ANU to support the development of Australia’s national unity and identity, including by improving Australia’s understanding of its Asia-Pacific neighbours, and its place in the international community.

Protecting the languages of our region

University-level study of Asian languages is in decline at a time when understanding those languages has never been more important for Australia’s engagement with this region – a region so crucial to our future prosperity and security. However ANU, unlike any other Australian university, maintains a depth and breadth of Asian languages, among them: Chinese (Mandarin and Cantonese), Japanese, Indonesian, Burmese, Melanesian Pidgin and other Pacific languages, Thai, Vietnamese, Korean, Hindi, Sanskrit, Tetum, Arabic, Persian and Turkish.

The University’s College of Asia and the Pacific takes a pioneering approach to developing language courses online, with a particular focus on the less commonly taught languages of Asia-Pacific.

In 2018, ANU began an agreement with Open Universities Australia to deliver online a range of lesser-taught languages from our region: Sanskrit, Hindi, Tetum, Thai, Tibetan and Vietnamese. This agreement builds on the University’s position as Australia’s primary tertiary education provider of less commonly taught Asian and Pacific languages. Taught online, the courses reach a far wider audience, helping Australia and the world to better understand the unique history, language and culture of the Asia and Pacific region. These six language courses have achieved a 100 per cent student satisfaction success rating.

In 2019, ANU will be the first university in Australia to offer Tok Pisin to students. As one of Papua New Guinea’s official languages, Tok Pisin is spoken by around four million people. The new course underscores the importance of deepening Australia’s understanding of one of its closest neighbours.

ANU is the most international university in Australia, ranking 10th in the world in the Times Higher Education World University Rankings.

Connecting specialist knowledge on Southeast Asia with the wider world

Hosted at ANU since 2006, New Mandala has grown to become a highly visible and influential forum for public debate on the Southeast Asian region’s political, social and cultural issues. New Mandala has flourished thanks to long-term National Institutes Grant support for academic time, and capacity and technical infrastructure for
what has become the world’s pre-eminent Southeast Asian Studies website. New Mandala often shapes major debates, with immediate public impact through genuinely open forms of publication. They reach an audience averaging two million readers per year, drawn from every country of Southeast Asia and more than 100 other nations around the world. New Mandala’s coverage of Malaysian and Indonesian politics has helped to form high quality discussions about democracy, economic reform and social inclusion. In 2019, New Mandala will generate the world’s best coverage of Thailand’s general election and Indonesia’s presidential election.

Capacity building in Myanmar

ANU has a strong connection with Myanmar, in particular, through the Myanmar Research Centre in the College of Asia and the Pacific. Following the inaugural Myanmar – Australia Strategic Dialogue led by the college’s Coral Bell School of Asia Pacific Affairs in 2017, ANU continues to build on these connections with the nation, particularly in the city of Yangon in southern Myanmar. In late 2018, a team of ANU academics from the College of Arts and Social Sciences and the College of Science’s Research School of Physics and Engineering visited the University of Yangon to build local capacity in research development, higher degree research student supervision and curriculum design. This was the first collaborative, cross-college approach to engagement with University of Yangon staff, with more than 60 participants from across the University attending the ANU-led workshops.

Global recognition for pioneering work on urban system sustainability in Asia

The University’s Professor Xuemei Bai was awarded the 2018 Volvo Environment Prize for her pioneering work on urbanisation and urban system sustainability in Asia and globally. The Volvo Environmental Prize is one of the most prestigious global awards recognising outstanding scientific discoveries in environment or sustainability fields. With more than two-thirds of the world’s population expected to live in urban areas by 2050, Professor Bai’s research focuses on understanding the drivers and impacts of urbanisation, cities as human dominant complex systems, and sustainability transition, particularly in Asia and the ‘global south’. Cities that are growing at rapid rates, such as Guangzhou in China, are struggling to keep up with the environmental pressures of population growth. The research and action agenda for cities and climate change developed from Professor Bai’s work was reported and approved at the Intergovernmental Panel on Climate Change 48th session.

Driving innovation and productivity in farming and food production across the Asia-Pacific

ANU and CSIRO have launched a new farming innovation centre at ANU to advance research, education and technology in farming and global food production. Building on the National Institutes Grant investment, the ACT Government and CSIRO have also contributed funding to help establish the new Centre for Entrepreneurial Agri-Technology (CEAT). CEAT brings together expertise from across ANU and CSIRO – particularly in environmental sciences, plant and agricultural sciences, engineering, computer science and economics – and applies that expertise to farming education, research and innovation. The need to find smart ways to double food production by 2050 to feed the world, sits in the context of a rapidly changing climate and other problems facing farmers. CEAT will be part of the solution to that challenge, driving industry innovation and productivity in farming and food production across the Asia-Pacific.
Contributing to public policy

The National Institutes Grant enables ANU to provide a national, regional and international public policy resource that addresses major issues confronting governments, business and communities.

Expertise in Pacific policy development

The Pacific Research Program (PRP), launched on 1 October 2017, is a consortium led by the Department of Pacific Affairs at ANU and includes the ANU Development Policy Centre and the Lowy Institute. The PRP is co-funded by the Australian Government Department of Foreign Affairs and Trade (DFAT), consortium partners’ parent bodies, and the National Institutes Grant. In its first year of operation, the PRP conducted high-quality research and analysis under five broad themes: politics, governance and the changing nature of the state; geopolitics and regionalism; urbanisation, land and resources; economic development; and gender, social change and inclusion.

The PRP made significant contributions to policy and debates under these broad themes, hosting the biennial State of the Pacific conference in September 2018 at ANU with more than 320 people attending. The Minister for Foreign Affairs, Senator the Hon Marise Payne, delivered the opening address at the conference, followed by a keynote address by the Pacific Islands Forum Secretary General, Dame Meg Taylor. The conference immediately followed this year’s Pacific Islands Forum meeting, setting up the first chance for collective reflection on the outcomes of the meeting of leaders at the forum.

Critical to its capacity to communicate its research for policy development is the PRP’s productive relationships with Pacific policymakers across Australian and regional governments, development partners, and civil society and private sector organisations. PRP has conducted more than 200 formal briefings/roundtable discussions in the last 12 months for a range of stakeholders, including DFAT, PM&C and the Prime Minister’s Office, Australian Federal Police, Australian Electoral Commission, Australian MPs, Australia Papua New Guinea Business Council, World Bank, US State Department, opposition members of PNG’s parliament, US–China Economic and Security Review Commission, Japan’s Ministry of Agriculture, Department of Agriculture and Water Resources, US Embassy, the ABC, UN Women, Honiara City Council, and the Prime Ministers of Solomon Islands and Tuvalu.

The PRP also shares policy expertise with the Australian policy-making community through intensive training courses, particularly on political economy and security issues in the Pacific.

The PRP is a global centre of excellence for research on the Pacific, confirming the University as the country’s foremost centre for the study of the Pacific.
Improving policy and practice in healthcare communication

The ANU Institute for Communication in Healthcare (ICH) was launched in February 2018 at the inaugural ANU International Symposium of Communication in Health Care. The interdisciplinary institute brings together internationally renowned experts from many disciplines – more than 100 academic, practising clinician, health policy expert and service provider members from 17 countries around the world. By working with healthcare professionals, the ICH aims to improve the quality of healthcare delivery by reducing the number of critical incidents caused by breakdowns in communication. In late 2018, ICH entities began establishing in the medical faculties at Harvard University, Nanyang Technology University and Hong Kong University. They will form an international peak body, led by ANU, focusing on cross-cultural comparisons, multilingual issues and universal problems in different healthcare settings that produce transnational research outcomes. Research being led out of the ANU ICH is already demonstrating an impact. For example, translating comprehensive, descriptive frameworks into innovative evidence-based interventions and policy recommendations has informed the new Australian Commission for the Safety and Quality in Healthcare standard on Communicating for Patient Safety. Further, research on clinician–patient communication in hospital emergency departments has been translated into the only evidence-based communication module for training future doctors based on what actually occurs in hospital contexts.

Analysis of China’s emission trading scheme

ANU led the analysis of China’s new national emissions trading scheme by a team of senior researchers from China, the United States and Europe. The research found enormous promise for more market-oriented climate and energy policy in the world’s largest greenhouse gas emitting country. But the initial stage of engagement will be gradual and many obstacles need to be overcome for the scheme to become an effective part of China’s policy portfolio. The analysis and other research on China’s energy and industrial transition is part of a program of bilateral collaboration that includes translation of research insights to policy audiences and the public. Through such a program Australia will gain an improved understanding of China’s climate and energy policies. ANU researcher, Professor Frank Jotzo, Director of the ANU Centre for Climate Economics and Policy, has been invited to become the only Australian member of a new task group on climate policy under the prestigious China Council for International Cooperation on Environment and Development.

Towards high quality end-of-life care for all Australians

The current piecemeal approaches to end-of-life care attract criticism of expenditure on such practices and generate demands for a nationally coordinated approach. The End of Life Care Roundtable was initiated by the Federal Minister for Health, the Hon Greg Hunt MP in November 2018 to map out end-of-life care in Australia by 2020. In support, a new program at ANU has established a network of researchers across the University who will support the development of a research strategy for ACT management of end-of-life care. This research will then be used to collaborate with others around the country to inform policy and practice for end-of-life care, and thus improve the provision of safe and high quality end-of-life care.

Improved decision-making in bushfire management

Research into bushfire management approaches has generated a new experimental flammability monitoring system being trialled by fire agencies. The result is better-informed decisions by land managers and fire agencies, for example with fire agencies rethinking how to use fuel information in their decision-making. This research has also influenced the new National Fire Danger Rating System. Overall, the research improves the anticipation of fire danger and thus reduces fire hazard.
Excellence in research and innovation

The National Institutes Grant enables ANU to maintain and enhance distinctive concentrations of excellence in research and education, particularly in areas of national importance to Australia.

ANU Grand Challenges Scheme

The ANU Grand Challenges Scheme, launched in 2017, is a $50 million program investing in transformative research on global intractable problems. It offers an investment, rather than a grant, and supports partnerships that will attract external investment. It is a deliberate effort by ANU to change the culture among its academics, to focus on addressing global challenges through collaboration between disciplines and with stakeholders. The scheme has broken through disciplinary boundaries to address major challenges confronting society. Proposals connected 23+ research schools from all seven colleges, non-college areas such as the National Centre for Indigenous Studies and National Computational Infrastructure, and well over 1,000 ANU academics.

The Our Health in Our Hands initiative, announced November 2017, is creating revolutionary personalised and wearable sensor technologies to monitor health conditions such as diabetes and multiple sclerosis, allowing more precise diagnosis and intervention. The Management Committee, established in partnership with ACT Health, will be complemented by a Scientific Advisory Board and Patient Advisory Board, with representation from internationally renowned scientists and health service experts, and patients. The four research programs have begun: sensor development, data analytics (including machine learning and cybersecurity), patient experience and genomics. Post-doctoral fellows and research teams are being recruited, clinical cohorts established, and external funding discussed. Preclinical validation of recently discovered candidate biomarkers is underway, in parallel with sensor platform development.

Zero-Carbon Energy for the Asia-Pacific, announced in September 2018, will research how Australia can become a major exporter of renewable energies to the Asia-Pacific. It will investigate four pathways for Australia to drive the region’s transition to zero-carbon energy production and use, identifying risks, challenges, barriers and opportunities to transforming Australia’s export industries, based on renewable energy.

To extend the impact of the Grand Challenges Scheme to other promising teams, three competitive finalist projects will receive seed funding: Humanising Machine Intelligence; Social Cohesion, Inclusion and Diversity; and Landscape Regeneration to Enhance the Earth System.
Excellence in research and innovation: health and medicine

Breakthroughs in malaria research

Forty per cent of the world’s population lives under the threat of contracting malaria; and more than 200 million people contract malaria each year. The parasite that causes the disease has become resistant to most drugs currently available. Research at ANU is helping the fight against malaria, including early detection devices and providing evidence of platelet protection in infectious disease.

Research Fellow, Dr Apostolos (Lee) Alissandratos, with the ANU Research School of Chemistry, is developing a new just-add-water diagnostic kit for use in remote communities to detect malaria and other diseases. It will allow early detection of the diseases. A safe micro-organism that produces all the biochemical reagents necessary to detect the malarial parasite was engineered using synthetic biology. At present, diagnostic tests for detecting the malarial pathogen are expensive and only effective when carried out in well-equipped laboratories operated by highly skilled staff. They are not available to the resource-limited communities where they are urgently needed. With the support of National Institutes Grant funding, proof-of-concept tests have been completed. Additional funding from the Bill & Melinda Gates Foundation will be used to develop ready-to-use devices over the coming 18 months. The approach has the potential to extend to the detection of almost any pathogen – in humans, animals or plants. Therefore, it could be applied in agriculture and farming, particularly in remote parts of Australia.

Further research into malaria, led by ANU and the Menzies School of Health Research at CDU, has found direct evidence of platelet protection in any infectious disease in humans. The research found that platelets bind to and kill parasites in patients infected with each of the major malaria parasite species – *Plasmodium falciparum, P. vivax, P. malariae and P. knowlesi*. They effectively reduce the number of parasites circulating in the blood. The findings suggest PF4-based peptides could be candidates for malaria treatment in the future, and demonstrate that platelets should be considered an important first-line defence for humans for protection from infectious microbes.

Saving sight

Around the world, 200 million people suffer with age-related macular degeneration (AMD). Now, thanks to the long-standing support of the National Institutes Grant, research into dry AMD at the John Curtin School of Medical Research (JCSMR) at ANU is delivering findings that could save millions of people from going blind. Dry AMD is a common eye disorder caused by damage to the macular – the part of the eye responsible for our sharpest vision. It can take years for signs of dry AMD to be found and by then the disease is often irreversible. Dr Riccardo Natoli from the JCSMR and the ANU Medical School is developing a blood test to detect the disease earlier based on a light model, thought to be the first of its kind. The model gives better insight into how the retina’s photoreceptor cells in the macular deteriorate. From the modelling, the team noticed an inflammatory response to the damage. The focus on early diagnosis and early treatment strategies that slow down this inflammatory response is hoped to slow the disease progression. This ground-breaking research is now further supported by an ANU funded Translational Fellowship Program and Beta Therapeutics has teamed up with the University to start testing drugs to slow the inflammatory response.
Changing lifestyles to improve the health and wellbeing of the nation

At least 70 per cent of Australia’s total healthcare burden comes from lifestyle diseases caused by behaviours such as smoking cigarettes, consumption of alcohol and unhealthy foods, lack of sleep or exercise, and high stress levels. In 2018, ANU initiated a range of research activities to find practical and informed policy solutions to these problems and make Australians healthier. The Research School of Psychology is developing a database of key references and resources to better understand the problem. This wealth of information would inform world leading education and practice in this field and would help Australians make informed decisions about their health. The researchers intend to develop a test battery that could easily identify the risk a person carries for various illnesses because of their lifestyle choices. A multidisciplinary team from across the University has already begun research, wholly funded by the National Institutes Grant, into the requirements for the test battery.

The future of personalised medicine

Most complex human disease is caused by changes in the genome. These are DNA sequence variations, that can be rare to reasonably common, and single to multiple. Many people have diseases caused by these changes. The Centre for Personalised Immunology (CPI) focuses on such immunological diseases and brings researchers at JCSMR and the ANU Medical School, into a collaboration with ACT Health and others. The Canberra Clinical Genomics centre is a collaboration between ACT Health and CPI and is a DNA diagnostics facility which identifies the DNA basis for a patient’s particular disease. An individual’s DNA is sequenced to inform a personalised diagnosis and establish the most effective therapy. This personalised medicine service is backed by strong bioinformatics, data management, research and clinical service delivery. Scientists introduce identified human genetic variation into a mouse model or human cell line to find out if the isolated mutation is responsible for the individual’s condition. So far the greatest impact has been on people with rare disorders based on a single abnormality, allowing doctors to deduce the mechanism of the disorder and find an effective treatment. CPI clinics are now running weekly and sequencing under this program increased by more than 300 per cent in the last year. In 2018, the Canberra Clinical Genomics centre received accreditation from the National Association of Testing Authorities and expanded its precision medicine service beyond immunology to rare paediatric diseases, familial cancer, congenital disorders, intellectual disability, haematology and renal disorders.

Drug discovery and development

Researchers at the University’s Research School of Biology, Research School of Chemistry, and JCSMR are working to develop drug discovery pipelines to move from target identification to phase II clinical trials for the treatment of various diseases. These pipelines will support the development of drugs targeting many more biochemical pathways. The ANU Drug Discovery Centre is focused on natural products from terrestrial and aquatic sources (as opposed to synthetic compounds) as a source of improved drug precursors.
A lifetime of scientific achievement

ANU Emeritus Professor Kurt Lambeck’s lifetime of scientific achievement was recognised with the Prime Minister’s Prize for Science, the country’s most prestigious science prize.

Since joining ANU in 1977, and with the long-term support of the National Institutes Grant, Professor Lambeck has researched the earth and its remarkable changes over time. He is globally recognised for his work to reveal how the earth changes shape every second and has done so since the dawn of time. His discoveries have been used for accurate planning of space missions, new methods of mineral exploration, and understanding the impact of sea level changes on human civilisation.

Professor Lambeck also guided the development of a comprehensive geodetic monitoring system, the AuScope network. The network of about 100 GPS stations, radio telescopes and laser tracking systems, enables location tracking with centimetre accuracy across Australia. The value of this infrastructure to Australia was confirmed this year with nearly $225 million of Commonwealth Government funding invested in a satellite-based augmentation system for the Australasian region and the National Positioning Infrastructure.

Professor Lambeck has received more than 30 international awards and distinctions, and served as President of the Australian Academy of Science. He continues to be a mentor and inspiration to many young, up-and-coming researchers looking to make an equally significant contribution in the fields of geophysics, geology, space science and glaciology.

Confirmation the earth’s core is solid

For the first time, ANU researchers have been able to confirm the earth’s inner core is solid, through the detection of shear waves – a type of wave which can only travel through solid objects. Inner core shear waves are so tiny and feeble they can’t be observed directly and detecting them was considered the Holy Grail of global seismology since scientists first predicted the inner core was solid in the 1930s. Researchers from the Research School of Earth Sciences developed the correlation wavefield method which compares the signals at pairs of seismic receivers between three and ten hours after a major earthquake. From the similarities of the signals the researchers construct a global correlogram – a sort of fingerprint of the earth – which can be used to demonstrate the existence of shear waves in the inner core and infer their speed. The research is vital in moving closer to a firm understanding of phenomena like planetary formation or how magnetic fields work.

New discoveries in the geological record

In 2018, the Research School of Earth Science made two significant discoveries that have altered the geological record. Research led from ANU with support from Geoscience Australia and researchers in the United States and Japan, discovered the oldest colours in the geological record. The 1.1 billion-year-old bright pink pigments – more than half a billion years older than previously discovered pigments – were extracted from rocks deep beneath the Sahara desert in Africa. The pigments are molecular fossils of chlorophyll produced by ancient photosynthetic organisms inhabiting a long-vanished ancient ocean. The second significant discovery was of molecules of fat in an ancient fossil which revealed the earliest confirmed animal in the geological record. It lived on earth 558 million years ago, millions of years before the earliest known animal beforehand. The creature, Dickinsonia, grew up to 1.4 metres in length and was oval shaped with rib-like segments running along its body. The finding confirms Dickinsonia as the oldest known animal fossil.
Next generation of environmental remote sensing and forecasting systems

With support of National Institutes Grant funding for the National Computational Infrastructure’s Raijin supercomputer, researchers in the ANU Fenner School of Environment and Society have achieved a number of scientific developments. One is a new method to assimilate moderate resolution imaging spectroradiometer (MODIS) satellite land surface temperature observations into a hyper-resolution global water balance model to estimate the water use of irrigation and wetlands. Another is a new forecasting approach that can warn of developing droughts with a lead time of three, to as much as six, months. Both developments inform decision-making by land and water managers, and improve weather and water forecasting systems, for overall better agricultural production, mitigation of natural hazards and reduced environmental impacts.

Australia’s leading resource for climate-change expertise

The University’s Climate Change Institute (CCI) plays a key role in facilitating expert contributions to Intergovernmental Panel on Climate Change (IPCC) reports. It also contributes leadership, such as the Director of the CCI, Professor Mark Howden, as an IPCC Vice Chair. Various IPCC reports have highlighted that atmospheric carbon dioxide needs to be removed at scale if Paris Climate Agreement targets are to be met. In response, the CCI pulled together researchers from across the University to focus on atmospheric carbon dioxide removal. This ‘negative emissions’ approach has centred on land based technologies, on developing a negative emissions house and on public acceptance and governance of negative emissions technologies. It is also developing research aimed at transforming the ability of Australians and our regional partners to adapt to climate change.
Excellence in research and innovation: society and culture

Filling the gaps in the world’s archaeological record

Archaeological research by Professor Sue O’Connor of the School of Culture, History and Language continues beyond traditional funding cycles thanks to long-term support from the National Institutes Grant. The professor’s work has uncovered many artefacts of record-breaking age, overturned many long-standing theories and filled gaps in the world’s archaeological record.

Professor O’Connor’s excavations in the Kimberley region of Western Australia discovered the world’s oldest stone axe dating back about 48,000 years. The axe showed evidence of an attached handle that demonstrated the sophistication and complexity of early Indigenous technology. Professor O’Connor also discovered the world’s oldest fishhooks associated with funerary rites in the remote Alor Island off East Timor. The set of five 12,000 year-old fishhooks, carefully placed in a Pleistocene-era burial of a woman, turned on its head the theory that men carried out most fishing activities on the islands.

Earlier in 2018, Professor O’Connor discovered evidence of the world’s oldest maritime fishing practices, millennia earlier than previously thought. Dated at 42,000 years ago, the findings suggest new answers to the puzzling question of how humans arrived in Australia 60,000 years ago. The popular theory had been that these early adventurers travelled from Southeast Asia, through Indonesia and Timor and then across the sea to reach Australia’s shores at land that is part of today’s Northern Territory. These new findings imply that they travelled through Indonesia’s northern islands, into New Guinea and then Australia, which were part of a single continent 50,000–70,000 years ago, when sea levels were 25–50 metres below the current level. This study helps to tell the Australian story, particularly for Indigenous people, and acknowledges the bravery, innovation and maritime technologies and skills of these early modern humans.

In 2018, Professor O’Connor was awarded the ANU Vice-Chancellor’s Award for Excellence in Research.

Developments in digital humanities

In 2015, the Centre for Digital Humanities developed the Online Cultural Collections Analysis and Management System (OCCAMS), a database with greater functionality than any other platform available for collection based research. In 2018, researchers worked with Bukku Larrnggay Mulka centre at Yirrkala to develop an app which can link OCCAMS to phones and other hand-held devices in order to upload to, or download from, the local server. This enables Yolngu people to access cultural materials such as repatriated images and to preserve data recorded on their devices in the community archive. The app helps build community archives and facilitates access to them. It has the potential to be used by other Indigenous communities and is supporting the Research School of Humanities and the Arts efforts to restore Indigenous cultural heritage.
New research into non-standard actors in political decision-making

In 2018, the Research School of Social Sciences conducted innovative new research into the role of social media in influencing politics. The research found that during the 2016 presidential election in the United States, Twitter bots were between two to five times more effective than humans in influencing political debate and engaging with voters. This research has paved the way for new research into non-standard actors in political decision-making. The University now has a unique resource and methodology at its disposal that can measure and analyse the impact online bots have on political discussion. This research has prompted negotiations with the Defence Science and Technology Group, within the Australian Government Department of Defence to form a strategic partnership for identifying the influence of online social networks. This partnership should ensure greater security in Australian society by being able to foresee links between online activity and potential real-world consequences.

Humanising machine intelligence

Machine intelligence promises to revolutionise decision-making by enabling us to draw on more evidence, more effectively than we ever could on our own. Machine intelligence systems are already prevalent in society and will only become more pervasive. But until now the research and development has focused almost exclusively on solving technical problems. The University, with seed funding from the National Institutes Grant-funded Grand Challenges Scheme, is supporting a new large scale initiative that crosses the boundaries of traditional STEMM (science, technology, engineering, mathematics and medicine) and HASS (humanities and social sciences) disciplines to humanise machine intelligence and ensure that efficiency gains from machine decision-making do not come at an unacceptable moral cost. This program will design more ethical machine intelligence systems through fundamental research and industry partnerships.

Social cohesion, inclusion and diversity

Social cohesion is fragile around the world and in Australia. Investment is needed in social infrastructure to strengthen social cohesion efficiently, effectively and quickly. Seed funding from the National Institutes Grant-funded Grand Challenges Scheme is enabling a multi-disciplinary team of ANU researchers with distinctive expertise in the area of social cohesion, diversity and integration, to take a five-stage approach – synthesis, stocktake, solve, scale-up and share – to this challenge. They will develop an interdisciplinary measure of social cohesion and identify how to strengthen social cohesion using robust methods that are scaleable and transferable to new communities.
The future of research

The National Institutes Grant enables ANU to maintain and further develop the University’s strong focus on research and the University’s educational philosophy that its students are part of a community of scholars.

ANU InSpace takes off

ANU has been Australia’s leading astronomy institute for decades, in part because of the National Institutes Grant’s long-term support of research and infrastructure in this discipline. As Australia’s national university we are home to key national space resources with the capacity and capability to support the future of Australia’s space industry.

To further build on this capability, ANU launched its new Innovation Institute, InSpace, to bring together extensive cross-disciplinary capabilities in technology, science and law research for advancing Australia’s space industry.

The Australian Government’s 2017 Foreign Policy White Paper predicts that Australia’s economic and security interests in space will increase considerably in coming decades. Launched by the Minister for Industry, Science and Technology, the Hon Karen Andrews MP, at Parliament House on Tuesday 23 October 2018, InSpace will be the front door to space activities and capabilities across the University. It will include technology research and development, science missions, space test facilities, commercial space law, and business and finance initiatives relating to space. It will drive co-investment with industry and government partners. The University’s unique combination of expertise in physics, computing, mathematical science, quantum mechanics, business and economics and law will sustain a focus on cross-disciplinary projects and initiatives to support Australian space business development.

Supporting the nation’s scientists to discover more of the Universe’s secrets

Building on the University’s successful operation of the nationally significant Siding Spring Observatory, ANU is leading a consortium of 13 universities to operate the Anglo-Australian Telescope (AAT), Australia’s largest optical telescope. The new operational arrangement of the AAT will ensure a continuing high level of capability in optical astronomy for the nation.
ACT Scientist of the Year

The future of artificial intelligence, secure networks, and the creation of new drugs is being brought closer to reality by research into quantum computing at ANU. Earlier this year Dr Rose Ahlefeldt, of the University’s Research School of Physics and Engineering, was awarded the 2018 ACT Scientist of the Year. The award recognised her work in identifying materials that can be used to enhance data storage for computers. Dr Ahlefeldt’s research, which studies fundamental science at the same time as building new technology, is creating the foundation for a new generation of quantum computers, which could build a quantum internet that allows for speeds and security of data transfer impossible with current technology.

Communicating science to the world

The University’s Centre for the Public Awareness of Science has run the Science Circus program for 30 years. The Australian Science Circus has already directly engaged two million Australians, and has plans to partner with Shell and Questacon over the next three years to engage another 100,000 rural, regional and Indigenous Australians each year. Science Circus also runs in Japan and other parts of the Asia-Pacific. Since 2015 the Science Circus Africa project has inspired young African people to the wonders of science in many parts of their continent. The project uses hands-on workshops and interactive exhibits, and passes knowledge to local teachers. Science Circus Africa has formed partnerships with eight African nations and engendered African-led science shows going out to the schools in their area and continuing the work that ANU researchers started in 2015.

Harnessing the unique capabilities of ANU for the future

The wealth of world-class technical expertise at ANU finds novel solutions to the challenges of the future. This extensive and diverse knowledge and experience is underpinned by significant, and often unique, instrumental infrastructure. The inaugural Research Capabilities Expo was held in 2018 to build closer links between expertise and infrastructure within ANU, following the launch of MakerSpace, an open-access digital design and fabrication space at ANU, in 2017. The Centre for Advanced Microscopy (CAM), which provides state-of-the-art microscopy and microanalysis equipment to researchers, students and industry partners, demonstrated at the expo. In 2018, CAM gave micro-imaging and microanalysis support to the research, development and innovation team at Aurubis AG, a major world-wide copper producer actively seeking to improve existing processes to deal with more and more complex raw materials. CAM’s microanalysis techniques obtain information such as metal loss and element deportment more accurately than conventional bulk analysis methods used at metallurgical processing plants. These advanced micro-imaging and microanalysis facilities can thus be directly used to support problem solving at the industrial level.

The future of legal technology

With the support of the National Institutes Grant, the ANU College of Law has developed a program of works on blockchain technologies that has attracted US$1 million of industry funding through the University Blockchain Research Initiative (UBRI). UBRI is a collaboration between industry and top universities around the world, including Princeton University and University College London, to support and accelerate academic research, technical development and innovation in blockchain, cryptocurrency and digital-payments. ANU is the only Australian university member of UBRI and the ANU College of Law is the only partner law faculty. ANU College of Law research will focus on the legal impacts of blockchain technology, such as smart contracts and cryptocurrencies. These research outcomes will form the basis of a larger body of work focused on the long-term impacts of legal technology and will include integrating changing technologies across ANU undergraduate and postgraduate curriculum.
Fostering the next generation

ANU has a proud history of providing a high-quality training ground for future research and academic leaders, supporting the next generation to realise nationally significant outcomes in their academic careers. These three outstanding current ANU PhD candidates, supported by the National Institutes Grant, are just some of those who are already making an impact.

Dr Naomi Clarke’s research in the ANU Research School of Population Health could help hundreds of millions of children worldwide by showing more can be done to reduce infection rates of intestinal worms. It is supported by both the National Institutes Grant and the Bill & Melinda Gates Foundation. Dr Clarke’s research found infection prevention doubled in effectiveness in community-wide versus child-targeted deworming. The study has raised the awareness of intestinal worm damage to health in the Asia-Pacific region, and authorities are now discussing and planning elimination and treatment strategies for the future. Her research was recognised in Dr Clarke’s selection as a finalist of the inaugural CSL Florey Next Generation Award, which recognises a current PhD candidate who has demonstrated outstanding achievement and potential in biomedical sciences, health and medical research.

In the ANU Research School of Economics, Mr Peter Gibbard is undertaking research on behavioural decision theory in three broad areas: models of framing effects, models of limited attention and models of online choice. Mr Gibbard expects to present his new model of online choice to the Australian Competition and Consumer Commission in early 2019. He is also a member of the Behavioural Insights Champions Network, which aims to inform the Australian Public Service of the insights obtained from behavioural economics to support evidence-based decision making.

Mr Ankur Sharma is researching micro- and nano-systems in the ANU Research School of Electrical, Energy and Materials Engineering. He is developing a computer chip made from pentacene, an organic carbon and hydrogen compound that will make mobile phones thinner, faster and more flexible in the future. The research will open the door to a new generation of high performance electronic devices made with organic materials that will be biodegradable or that can be easily recycled, promising to help substantially reduce e-waste. Mr Sharma applied to do his PhD at ANU because of the “wonderful lab facilities” at the Research School of Electrical, Energy and Materials Engineering, which could not be maintained without the long-term investment of the National Institutes Grant.