

# FOCUS

## THE CRISIS IN AGEING

TECHNOLOGY TO HELP  
MANAGE THE CHALLENGES  
IN HEALTHCARE





# Clunies Ross Awards

## 2018 CALL FOR NOMINATIONS

**The Clunies Ross Awards have a proud 25-year tradition of recognising contributions by dedicated individuals who have shared their vision and knowledge with others to apply technology for the benefit of Australia.**

**Do you know a science and technology entrepreneur? Someone who has commercialised technology? Or someone who had led the adoption of technology?**

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### **NOMINATE THEM FOR A 2018 CLUNIES ROSS AWARD**

Nominations are now open and must be submitted by 2.00pm AEDT on Friday 27 October 2017.

In 2018 the Clunies Ross Awards will be awarded in three categories with a single winner in each category.

#### **CLUNIES ROSS ENTREPRENEUR OF THE YEAR AWARD**

For those who have played a leadership role in the translation of a technology-based product or service that has led to financial success and demonstrated impact for Australia, and in which they have personally had a significant input in the inventorship or development of the technology. Such a person would typically have business responsibility as a CEO or a senior manager and may be working in either an early stage SME or a mature company environment.

Typically this would be an entrepreneurial person leading an activity that is disrupting well established vendors or commercialising new opportunities through innovative use of new technologies.

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For those who have been responsible for the development and adoption of a technology and for sharing their knowledge leading to commercialisation, for example by licensing with a financially successful outcome.

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#### **CLUNIES ROSS INNOVATION AWARD**

For those who have been responsible for the development and adoption of a technology that has significantly improved societal and/or industry capabilities. In this case the primary outcome is not a financial benefit but has measurable broad community or industry impact.

Typically this could be a researcher or developer in a Public Funded Research Organisation, university or private company, where the outcome is in the form of industry development, or measureable improvement in community well-being or sustainability measures. Examples could include technologies that improve remote monitoring of agriculture/ecosystems, or improved access to remote learning and health care.

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For further information visit [www.atse.org.au/cluniesrossawards](http://www.atse.org.au/cluniesrossawards)

Submit your completed nomination form by 2.00pm AEDT Friday 27 October 2017.

The Australian Academy of Technology and Engineering (ATSE) administers the Clunies Ross Awards program.

For more information contact the Clunies Ross Awards coordinator via email [clunies.ross@atse.org.au](mailto:clunies.ross@atse.org.au)

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Front cover photo: Going to the heart of health care (Photo: iStock)

## FOCUS

ATSE *Focus* is produced to stimulate discussion and public policy initiatives on key topics of interest to the Academy and the nation. Many articles are contributed by ATSE Fellows with expertise in these areas. Opinion articles will be considered for publication. Items between 800 and 1400 words are preferred. Please address comments, suggested topics and article for publication to [editor@atse.org.au](mailto:editor@atse.org.au).

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BY SONIA WUTZKE  
sonia.wutzke@saxinstitute.org.au

# Technology is only part of the answer

**THE CRISIS IN AGEING** More than 40 per cent of cancers could be prevented if known risk factors were eliminated.

**C** Chronic disease is a serious and urgent population health problem. In Australia, chronic diseases (including cardiovascular diseases, cancers, chronic respiratory diseases and diabetes) and their biomedical risk factors (such as obesity, hypertension and high cholesterol levels) are the country's biggest health challenge, responsible for 83 per cent of premature deaths (deaths among people aged less than 75 years) and two-thirds of the total burden of disease.

The cost of chronic diseases to the community is considerable and growing. The Australian health system spends an estimated \$27 billion a year treating chronic diseases – 36 per cent of all health spending.

However, this burden extends beyond impacts on the health system to impacts on individuals and their families, as well as to adversely impacting workplace productivity, workforce participation and economic growth.

Fortunately, many major chronic diseases are largely preventable. Behaviours such as smoking, alcohol consumption, poor nutrition and physical inactivity are responsible for many chronic diseases. These behaviours increase the risk because they raise blood pressure, lead to overweight and obesity, and cause high levels of glucose and/or fat in the blood.

Nearly all Australian adults have at least one risk factor for chronic disease – half of us have two or three. The World Health Organization estimates that 80 per cent of all heart disease, stroke and Type 2 diabetes and more than 40 per cent of cancers could



PHOTO: SHUTTERSTOCK

*Saying no to diabetes.*

be prevented if known risk factors were eliminated.

Despite some successes, notably in tobacco control and associated reductions in lung cancer deaths and deaths from chronic obstructive pulmonary disease, Australia – like other countries – has been unable to successfully reverse or even contain the rising burden of chronic disease and their risk factors:

- 63 per cent of Australian adults are overweight or obese;
- 45 per cent do not meet physical activity recommendations;
- 48 per cent consume too much sugar;
- 18 per cent drink alcohol at risky levels;
- 33 per cent have high cholesterol; and

- 23 per cent have high blood pressure.

Like other countries, in Australia much effort to prevent chronic disease has focused on individual behaviour – encouraging people to eat more nutritious food, to move more, to not smoke and to drink less alcohol.

Health technologies have a role to play here:

- eHealth technologies, for example, have been successfully used to provide education and support through telehealth and telephone-based services; and
- mHealth technologies have also demonstrated effectiveness in promoting healthy behaviours, especially for increasing physical activity and/or weight loss and supporting smoking cessation

through SMS/MMS, mobile apps, PDAs and remote or web technologies.

There is also growing interest in the use of genetic testing to improve diagnosis of predispositions to chronic disease and trigger individualised prevention efforts.

Efforts to change individual behaviour, even with the support from health technologies, is however fundamentally flawed – this is too narrow a view that does not recognise the dynamic interplay of the biological, social, physical, cultural and economic factors that combine in non-linear ways to shape individual choices, exposure, risk factor development and disease incidence and progression.

### FUTILE EXPECTATION

It is futile expecting an individual to exercise more if there is no safe, green space in the area in which they live.

Equally, one can't insist an individual eats a more nutritious diet, free from fatty, high-salt, fast foods, if they can't access fresh and

affordable fruits and vegetables in their area.

Complex problems such as chronic diseases do not respond to simple, independent, one-off solutions that focus on one part of the problem, for example individual behaviours and individual choices. Rather, they require a deliberately coordinated portfolio of sustained, whole-of-population, inter-sectoral, cross-governmental actions. This requires a complex systems approach.

A complex systems approach to improving the prevention of chronic disease conceptualises poor health and health inequalities as outcomes of a multitude of interdependent elements within a connected whole.

These elements affect each other in sometimes subtle ways, with changes potentially reverberating throughout the system.

A complex systems approach to chronic disease prevention would use a broad spectrum of methods to design, implement and evaluate interventions that recognise and

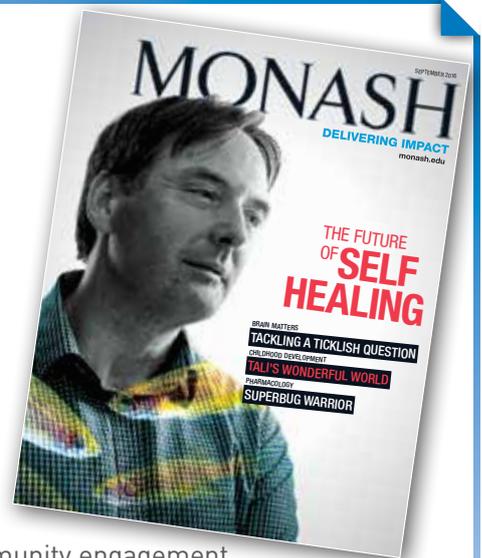
intervene in the (connected) root causes of a problem.

Health technology has an important role to play in this, but only if integrated as part of a deliberately coordinated portfolio of actions that recognises and impacts on the complexity of chronic disease.

Tackling the whole system – where people live, work and play – will help us to create an environment that supports people to make better health decisions and avoid chronic disease. ☺

*Associate Professor Sonia Wutzke is Head of the Analysis and Evaluation Division of the Sax Institute and Deputy Director of the Australian Prevention Partnership Centre, a national initiative identifying systemic improvements to the prevention of lifestyle-related chronic diseases. She has more than 20 years' experience in senior and executive management roles in academia, the not-for-profit sector and state government. Her research interests include systems approaches to improving population health outcomes, operationalising knowledge from research and practice, the power of organisational networks for innovation and change, and learning from implementation of large-scale public health initiatives.*

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BY TIM BLAKE  
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# The rise of the engaged patient

**THE CRISIS IN AGEING** Moving to a model of partnership between patient and health provider is critical to long-term efficiency and sustainability.

**R** Recently I've heard many people using the phrase 'health consumers' instead of 'patients'. Patients, health providers and software vendors are all starting to speak in this way. And I like the fact that they are.

But as so often happens when we use a new phrase, I think many people haven't fully understood its meaning or far-reaching implications. In the same way that many people are using 'digital health' simply (and incorrectly) to replace 'eHealth', others think that 'health consumers' is just a modern way to refer to 'patients'.

Let me clear up some of that confusion.

## CONSUMERISM

A **patient** is somebody who is currently actively engaged with the health system – somebody with a diagnosed condition that is under treatment or care.

A **health consumer** is somebody who is either engaged in current use of preventative or wellness solutions, making financial decisions about future potential care, or is currently a patient.

A **consumer** is a person who purchases goods and services – a person who has expectations and exercises choice. And when a service consistently fails to live up to those expectations, consumers are prepared to act, and to take their business elsewhere.

In my parents' generation, the doctor was always right. Having a doctor was rightly considered a privilege, and it was very rare

that patients would question his or her decisions. It was almost unknown for people to move between doctors.

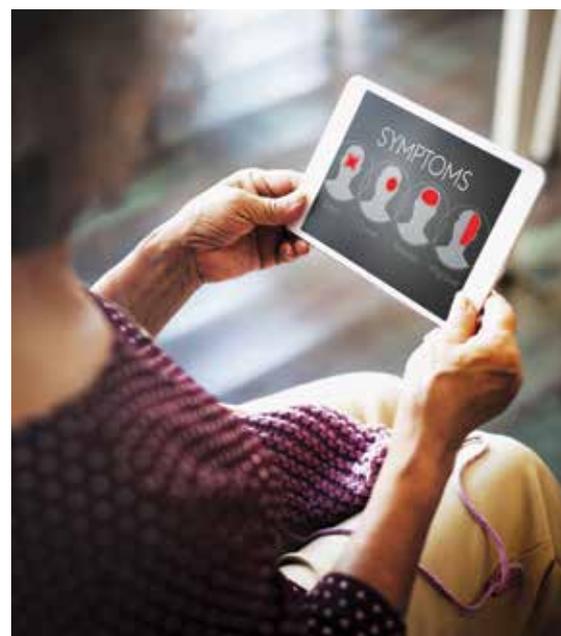
However, over the past generation, patients are increasingly behaving as consumers of healthcare.

Many of you reading this will have had the experience of moving doctors because you haven't been happy with the service that you've had. In some instances, this is about accessibility to a service (i.e. the ability to get an appointment in a timely manner). In others, this is about perceived (or actual) quality or price.

Patients are no longer the captive audience that they once were.

In many health systems around the world, patients are increasingly out of pocket for their healthcare. The more this becomes true, the more patients will take those out-of-pocket dollars and use them to exercise choice.

In other words, the more that healthcare becomes unsustainable and unaffordable, the more health consumers will act as a market-based counter-balance. This may serve to



*The 'digital native' has arrived.*

PICTURE: ISTOCK

finally work against the artificial, provider-driven demand in the system.

## DIGITAL EXPECTATIONS

In addition to exercising choice, a growing proportion of health consumers are 'digital natives' – people who are tech savvy and who don't just tolerate, but increasingly expect, digital services in healthcare.

The excuse from health providers that

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## LETTERS TO THE EDITOR

ATSE *Focus* welcomes letters from readers in response to published article or on technology related topics. Please keep letters brief. Longer letters may be run as contributed articles.

Please address to [editor@atse.org.au](mailto:editor@atse.org.au)

# BATTERHAM MEDAL

## FOR ENGINEERING EXCELLENCE



**One of Australia's most innovative young engineers will win the 2017 Batterham Medal.**

**NOMINATIONS OPEN 1 JUNE AND CLOSE 31 AUGUST.**

The Batterham Medal is an early career award for a graduate engineer who has achieved substantial peer/industry recognition for his/her work in the past five years. The Academy administers the award on behalf of the Group of Eight Deans of Engineering and Associates and the Medal will be awarded at ATSE's Oration Dinner on 24 November 2017 in Sydney.

The winner will receive the Batterham Medal and a cash prize of \$5000.

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**THE WINNER WILL BE AN ENGINEERING GRADUATE OF AN AUSTRALIAN UNIVERSITY, UNDER 40 AT 1 JANUARY 2017 AND WILL:**

1. have demonstrated excellence, innovation and impact in a field of engineering;
2. be clearly acknowledged by peers for a signature contribution to engineering in the five years prior to his/her nomination; and
3. have advanced the standing of the engineering profession.

The Batterham Medal recognises **Professor Robin Batterham AO FEng FAA FTSE**, an Australian science and technology leader who was Chief Scientist of Australia from 1999 to 2006, President of the Academy from 2007 to 2012 and is Kernot Professor of Engineering at the University of Melbourne.

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**THE BATTERHAM MEDAL GUIDELINES AND NOMINATION FORM ARE AVAILABLE AT [www.atse.org.au/batterham-medal](http://www.atse.org.au/batterham-medal)**

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**NOMINATE AN INNOVATIVE YOUNG ENGINEER TODAY.**

“the government doesn’t pay us to support digital technology” doesn’t wash with a generation whose first question is often “Is there an app for that?”

The coming together of digital expectations with health consumers who are increasingly out of pocket for healthcare will act as a lever for change.

Regardless of funding models, we will see health providers, particularly in the primary care sector, realise that offering digital services to patients is a competitive advantage.

Since the patient is no longer a captive audience, health providers will be able to use digital services to entice patients and load up their practices with greater numbers of patients than ever before, using the efficiencies that digital technologies can bring – i.e. the ability to monitor and risk stratify patients remotely.

As a health consumer, it would be good to see a move towards funding models that reward health outcomes as well as occasions of service. But, regardless of whether we see those changes in two or 20 years, the expectations of increasingly digitally savvy health consumers will be a driver of choice, accessibility and quality, which in turn will drive the adoption of new, digitally enabled models of care.

## GLOBALISED HEALTHCARE

Using digital technologies allows virtual access to medical services around the world.

For example, I personally use a consumerised sleep-tracking device to monitor the quality of my sleep, following a diagnosis of mild sleep apnoea a couple of years ago. And the sleep physician who helps me understand the data generated by the device is based in the US, not in Australia where I live.

In the same way, many digital technologies will allow new ways of quickly matching demand with global supply. Health consumers will increasingly have the choice to seek out high- quality, affordable health services in many specialities from anywhere around the world.

This dynamic could significant impact our assumptions about future healthcare price inflation and the supply/demand equation within particular countries. For example, rampant healthcare price inflation in some

## “Nothing about me, without me.”

– ePATIENT DAVE

parts of the US and Australian systems may see health consumers begin to trickle – and then flood – towards lower-cost, high-quality virtual services delivered out of Asia and India.

I’m not saying that in all cases this is desirable, or even safe. Of course it needs to be regulated. But it is starting to happen. And it’s going to hit hard and fast, and take us by surprise.

Enabled by digital technologies, healthcare will quickly be globalised, as health consumers seek more accessible, higher-quality and more affordable healthcare.

## PARTNERSHIP MODEL

As our health systems slowly (and quite often reluctantly) become aware of the importance of listening to health consumers, and the growing evidence base to support the fact that engaged patients get better health outcomes, I want to make the case for developing a partnership model between patients and doctors.

An engaged patient is:

- a health consumer who participates fully in his or her medical care;
- somebody who takes responsibility for their own health outcomes;
- somebody who has a voice in their own care, and exercises choice where that is appropriate; and
- somebody who speaks up for themselves, or for those that they are caring for.

“Nothing about me, without me,” as ePatient Dave’s mantra goes.

Engaged patients see themselves as equal partners with their doctors in the healthcare process. Engaged patients gather information about medical conditions that impact them and their families, using digital tools in coping with medical conditions.

Now, of course not all patients are engaged patients. Some patients will never be engaged. And many patients with poorer social determinants of health struggle with engagement, by definition.

But we need to see engagement as a relative concept. Patient engagement is ultimately about improving patient health behaviours and literacy, relative to where

those things sit today. It’s about shifting people up the behavioural and health literacy curve.

It’s important to recognise that great doctors have been working in partnership with their patients for years. The best practice isn’t always new practice. Sometimes it’s about rediscovering things that we did better in the past.

Unfortunately, however, there aren’t enough great doctors, and most doctors still don’t practise this way. Paternalism in medicine is still rife.

The need to move towards a partnership model is exacerbated by the fact that our digital age has led to an explosion in the rate of publication of medical knowledge. Approximately 800,000 scholarly medical articles were published in 2014 alone.

It’s literally not possible for doctors to be across even a fraction of the new developments and knowledge in medicine. Doctors must work hand-in-hand with highly motivated, but unqualified, patients to guide that motivation in appropriate directions.

I’m with ePatient Dave (the original engaged patient from the US) when he says “patients are the most under-used resource in the health system”.

Moving to a model of partnership between patient and health provider is not an optional extra for our health systems, but critical to long-term efficiency and sustainability.

A successful partnership with a patient begins when a clinician is prepared to move away from paternalism and say: “You know what, I don’t know. Let’s work this out together.” ☺

*Mr Tim Blake is the Managing Director of Semantic Consulting, a consulting firm focused on leading digital change in healthcare. He is passionate about enabling engaged patients, activating caregivers, the use of mobile solutions in health, consumer health technology, precision medicine, consumer genomics and many other components of digital health that are disrupting healthcare in positive and exciting ways. He was formerly Chief Information Officer of the Tasmanian Department of Health and Human Services, Director of Rural eHealth Strategy at New South Wales Health and Strategic Adviser at Australia’s National eHealth Transition Authority (NEHTA) and the Commonwealth Department of Health.*



BY STEPHEN BEIRNE  
sbeirne@uow.edu.au

# 3D printing has major impact in medical care

**THE CRISIS IN AGEING** We are now on the cusp of a wave of new therapies, implants and treatments that will be no longer be composed of just a single printed material to perform a structural function.

**S**ince the advent of 3D printing, already more than 30 years ago, we have seen a radical revolution in the principles of design and manufacture across most facets of production industries.

But perhaps the most dramatic impact of the US\$5 billion+ additive manufacturing

industry will soon be seen in the field of medicine.

By its nature, medicine requires personalised solutions, which is an unrivalled strength of the additive manufacturing approach due to the freedom of design variation it can accommodate.

The magnitude of impact that 3D printing has had in medicine is vast. We are at a point

now where additive technologies are used throughout clinical workflows, from forming an integral part of pre-operative planning to providing the tools and implants required for treatment, as well as aiding in patient recovery. *Wohlers Report 2016*, the pre-eminent annual review of the 3D-printing industry, highlighted that the medical/dental sector made up 12.2 per cent of the 3D-printing market.

## CAN TECHNOLOGY SOLVE HEALTHCARE CHALLENGES?

Is technology the answer to the challenge of our ageing population and rising healthcare costs?

This was the topic explored at the 2017 ATSE National Technology Challenges Dialogue *The Crisis in Ageing – Technology to Manage the Challenges in Healthcare*, held at Queensland University of Technology in Brisbane in June.

More than 80 entrepreneurs, decision-makers, government officials, researchers, academics and business leaders discussed a raft of technology – including apps, artificial intelligence, nanotechnology, smart homes, genetic testing and 3D printing – as they explored in four sessions:

- Active ageing – the challenges we face;
- Leap-frog health technologies;
- Towards personalised healthcare; and
- Prevention for a better future.

The day-long Dialogue highlighted ATSE's consistent commitment to leading the public discussion on Australia's future prosperity with a focus on using the best of Australian and international technologies to address our national challenges.

It was facilitated by Dr Norman Swan, national medical issues commentator and producer/presenter of *The Health Report* on ABC's Radio National.

Introductory speakers included: Professor Paul Greenfield AO FTSE, Chair of the 2017 NTC Dialogue Committee; Professor Arun Sharma, Deputy Vice-Chancellor (Research and Commercialisation), QUT; and Professor Hugh Bradlow FTSE, ATSE President.



Andrea Maier poses a question.



Paul Wood at the lectern.

The four sessions were chaired by: Professor Paul Wood FTSE, Director, P&R Wood Partners; Mr John Grace FTSE, Director, TechAdvisory Pty Ltd; Dr Carrie Hillyard FTSE, Chairman, Fitgenes Pty Ltd and an ATSE Director; and Dr Rob Grenfell, Health Director, Health & Biosecurity, CSIRO.

Professor Ian Frazer AC FRS FAA FTSE FAHMS, Ambassador and Chair, Translational Research Institute Foundation Board, Professor, Faculty of Medicine, University of Queensland, and President of the Australian Academy of Health and Medical Sciences, concluded the Dialogue, discussing urban design to stop isolation in old age.

The Keynote address was a live videocast from the US by international healthcare authority Mr Hal Wolf, National Director of Information and Digital Health Strategy, The Chartis Group, which is a national advisory services firm in the US that provides strategic and economic planning, value-based care, clinical transformation and



*The Biopen – a hand-held, freeform biofabrication tool.*

It is now commonplace to use these datasets to produce models of an area of interest, for example to highlight the location of a concealed tumour.

Continual software developments enable complex segmentations of bone, tissue and blood vessels to be performed.

Physical realisation of these multi-element models, in mesmerising detail, using today's latest full-colour 3D-printing technologies results in invaluable pre-operative tools that allow clinicians to communicate clearly with their patients and colleagues in the preparation for surgical procedures.

As can be seen in other industries, these technologies are no longer restricted purely to being used to make aesthetically pleasing models. The same processes, using biocompatible polymer or metallic feedstocks, are being used to produce functional and often life-changing patient-specific implants.

A headline story of 2012 was the successful implantation of a complete printed titanium mandible in the Netherlands. The following year news emerged of a surgical intervention in the US that used a 3D-printed bio-resorbable stent to prevent the airway of an infant child from continually collapsing.

At the same time, patient-specific, load-bearing implants have been under development locally in Australia. A now classic 2014 example is that of the collaboration between Professor Peter Choong, Director of Orthopaedics at St Vincent's Hospital, Melbourne, Victorian-based implant design and development specialists Anatomics, and CSIRO to design, produce and ultimately implant a bespoke titanium heel bone for a 71-year-old male patient to replace cancerous bone and avert the need for amputation.

#### WHERE WE'RE GOING

These brief examples are just a drop in the ocean among the innovative printed approaches that medical professionals have

CONTINUED ON PAGE 12

#### WHERE WE ARE

Advances in additive fabrication technologies – and there are many – have gone hand-in-hand with improvements in imaging technologies such as CT (computed tomography) and MRI (magnetic resonance imaging), allowing us to routinely capture the high-resolution data essential to the construction of accurate 3D-printable models.

information technology consulting services and decision-support tools to the country's leading healthcare providers.

Key speakers included:

- Professor Kenneth Hillman AO, Professor of Intensive Care, Liverpool Hospital, University of New South Wales;
- Professor Elizabeth Geelhoed, Professor at the School of Population and Global Health, University of Western Australia;
- Professor Hugh Bradlow FTSE, ATSE President;
- Dr Priscilla Rogers, Senior Manager, Cognitive Health and Life Sciences Research, IBM Research Australia;
- Dr Stephen Beirne, Research Fellow, Intelligent Polymer Research Institute, University of Wollongong;
- Professor Ranjeny Thomas FAHMS, Arthritis Queensland Chair of Rheumatology, University of Queensland;
- Associate Professor Travis Klein, IHBI Theme Leader – Injury Prevention and Trauma Management, QUT;
- Dr Denise Furness, Molecular Geneticist and Nutritionist, Director/Consultant, Your Genes & Nutrition;
- Professor Ingrid Winship, Executive Director of Research, Melbourne Health, Chair of



*Ranjeny Thomas shares her knowledge.*

- Adult Clinical Genetics, University of Melbourne;
- Mr Tim Blake, Managing Director, Semantic Consulting;
- Associate Professor Sonia Wutzke, Deputy Director, The Australian Prevention Partnership Centre;
- Dr Elizabeth McGrath, Director, Conformity Assessment, Medical Devices Branch, Therapeutic Goods Administration; and
- Professor Rajesh Vasa, Deputy Director, Deakin Software & Technology Innovation Laboratory, Deakin University

About 30 of the attendees were involved in a facilitated half-day workshop the following day, which sought to synthesise the Dialogue discussions and produce an outcomes document that will be the basis for a Health Technology Forum Action Statement. (see page 15)



*Panel members on the spot.*

The logo for The Australian Power Institute (API) is a blue circle containing the letters 'API' in white. Below the letters, the text 'The Australian Power Institute' is written in white.

API

The Australian  
Power Institute

A collage of four images related to power engineering: 1) Three people in hard hats and safety vests looking at a laptop on a solar panel array. 2) A large industrial building with a glass facade. 3) A large dam or power station structure. 4) Two people in hard hats looking at a tablet in front of a wind turbine.

*Our vision is to create sustainability and excellence in Australia's power engineering.*

## What is the API?

The Australian Power Institute (API) is a not for profit national organisation established by the Australian power industry to boost the quality and numbers of power engineering graduates with the skills and motivation for a career in the energy industry which encompasses:

- Generation, transmission and distribution utilities
- Manufacturers and suppliers to the industry
- Consultants to the industry
- End users of electricity in their operations.

## Value Proposition

To deliver a sustainable supply of highly skilled power engineering professionals working effectively to meet the challenges of creating Australia's new energy future, and underpin the technical and commercial success of member companies in the energy sector.

The key objectives of API are to achieve the following:

- Provide a sustainable supply of quality power engineering graduates to industry
- University power engineering teaching and learning provides relevant industry skills
- Value added continuing professional development programs
- A respected organisation leading the national development of power engineering skills.

## Further Information

Contact - Mike Griffin (Chief Executive)

0419 643 795

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 [www.api.edu.au](http://www.api.edu.au) and [www.powerengineering.org.au](http://www.powerengineering.org.au)



BY PRISCILLA ROGERS  
prrogers@au1.ibm.com

# What happens when we all live to 100?

**THE CRISIS IN AGEING** We are on the verge of a new era that could enable more of our elderly population to stay at home longer, while providing peace of mind to family and doctors.

**A** century of life was once a rare privilege, with just 120 Australians reaching 100 only 40 years ago. Today we have more than 3000 centenarians and this is estimated to increase to 40,000 by 2055. The Royal Family will certainly have its work cut out writing that many letters to our ageing Aussies!

Globally, we're expecting the ageing population (over-65-year-olds) to double in the next 20 years, disrupting economies as the costs for caring for seniors also doubles.

The ageing population is the greatest challenge facing our economic infrastructures today. There is a critical need to relieve the strain that is already starting to fall on our health and social systems and a big part of achieving this is preserving the independence of our seniors as long as possible.

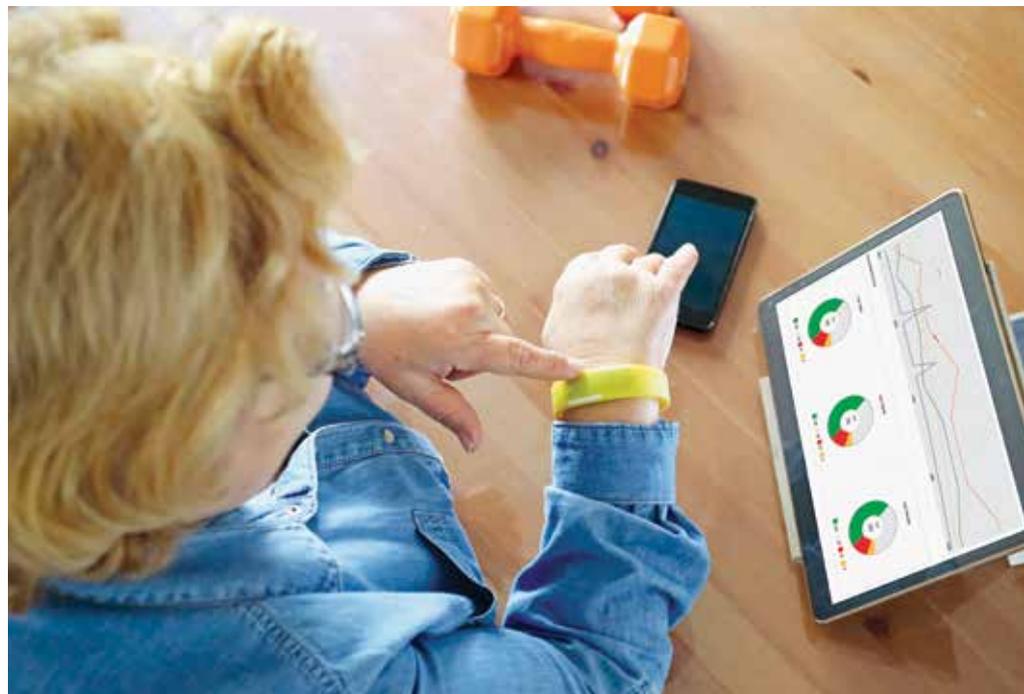
Preserving independence is critical to quality and longevity of life.

Moving a loved one into a care facility too early increases their risk of depression and health decline – they are three times more likely to suffer from depression in care facilities than those living in the community. Experts believe this is because of fear, isolation and a sense of helplessness.

And then there's the economic factor, with the cost for an aged care facility as high as \$106,000 per year – quite a sum for both the health system and the families if the loved one is moved into a facility prematurely. Yet moving them too late could risk their safety.

## AGEING IN PLACE WITH AI

'Ageing in place' is a movement to provide the infrastructure and support to enable people



*Ageing at home with technology.*

PHOTO: ISTOCK

to live in their homes as long as possible, which could have far-reaching benefits economically, socially and for the overall quality of life of the elderly population.

This sounds like a pretty obvious goal, but until now, seniors have made the transition based on family or doctor opinion, or after a worrying incident.

With emerging technologies like the Internet of Things and cognitive technologies, we are on the verge of a new era that could enable more of our elderly population to stay at home longer, while providing peace of mind to family and doctors.

Tiny, ambient sensors that can measure things like sound, motion, lights or even carbon dioxide levels in a home can provide an incredibly rich source of information about an individual's daily life – but in a way that's

almost seamless to the person.

Data from these sensors can be coupled with artificial intelligence (AI) and cognitive technology to develop holistic behavior patterns for individuals – for example, what time they tend to cook breakfast, which would see a rise in CO<sub>2</sub> levels, or when they go for a walk in the afternoon.

This 'individual' factor is key – ageing affects us all, yet in different ways, so we must not treat our seniors as a homogenous population.

These holistic behavioural patterns for an individual could allow family members, doctors and caregivers to proactively monitor the health and well-being of their loved ones and alert them in real time to scenarios when the seniors may need support – scenarios such as a stove being left on or a door being

opened in the middle of the night.

The technology is already emerging and it's a matter of integrating it in a way that makes sense for our senior community and aged-care system.

Loneliness, depression, dementia, and Alzheimer's and Parkinson's diseases are all devastating neurological conditions that affect far too many people, particularly in our ageing population.

Loneliness has been shown to have health risks equivalent to those of smoking and diabetes, with an overall 26 per cent increase in mortality. Meanwhile, alarming figures indicate that Alzheimer's and dementia are on the rise, and there is no cure yet in sight.

We are researching ways to predict these neurological conditions as early as possible in an effort to heighten our chances of slowing the rate of cognitive decline (and preserving independence along the way),

as well as preparing the patient and the family for what's ahead – as much as you reasonably can.

There are new abilities to map the connections in the brain with artificial intelligence that could reveal new insights into the evolution of our cognitive function as we age. This insight is going to have a profound impact on healthcare, particularly in our senior community.

A research project at the IBM Austin Research Laboratory in Texas combines artificial intelligence with robotics in the form of an in-home assistant. Not only could it help monitor vital signs, such as heart rate and breathing through visual recognition, but could also respond to human emotions through vocal cues and facial expressions.

For the next generation coming through, AI technology and in-home assistants will likely become the norm. With AI technology

that can understand tone and emotion, we could be well on our way to keeping our seniors in their homes as long as possible, while helping them feel more connected and supported.

I am personally excited about the role technology will play in helping identify and mitigate risk in the aged and improve the quality of life through personalised insights and timely recommendations. ☺

*Dr Priscilla Rogers is the Senior Manager of the Cognitive Health & Life Sciences Research team at IBM Research – Australia, where she leads a multidisciplinary team in the area of data-driven healthcare. This spans medical image analytics through to the application of brain-inspired computing systems to complex challenges in the health system. In her role, she is responsible for defining and driving the research agenda. Her passion for healthcare and life sciences research began when she undertook a PhD in Engineering at Monash University, specialising in the exploitation of micro- and nanoscale phenomena for diagnostic applications.*

From page 9

### 3D printing has major impact in medical care

been reporting over the past five years.

While regulators such as the FDA (US Food and Drug Administration), EMA (European Medicines Agency) and our own TGA (Therapeutic Goods Administration) are developing strategies for how to introduce standards into 3D-printed implants, the sheer pace of development in this space, the inherent individuality of each implant, as well as the variety of different data preparation and manufacturing processes being used, poses them a significant challenge.

What makes this even more challenging is that we are now on the cusp of a wave of new therapies, implants and treatments that will no longer be composed of just a single printed material to perform a structural function.

Additive technologies allow structures to be produced from multiple independent materials (inks) simultaneously. At a research level, previously unimaginable constructs, containing structural components, cells and bioactives such as growth factors can be printed on demand. This opens up a raft of new treatment opportunities.

An example is the Biopen, a handheld 3D-printing tool that has been developed

between the ARC Centre of Excellence for Electromaterials Science at the University of Wollongong and Professor Choong's team at St Vincent's Hospital.

Conceptualised specifically to enable a novel approach to cartilage repair, the device itself is assembled from 3D-printed components, most importantly including a coaxial titanium nozzle.

The Biopen, which has now entered animal based trials, is used to deliver multiple hydrogel 'inks' directly to the cartilage defect site to stimulate repair.

Of course the ink and its structure are critical to these treatment strategies. As bodies of research grow we have seen the emergence of a bio-ink industry – an array of established companies across the globe now equipped to supply researchers with a multitude of biomaterials, including hydrogels, bio-resorbable polymers and bio-ceramics.

The compositions of these materials have been specifically formulated and tuned to be compatible with printing processes, maintain cells during the process and support their growth following printing.

We are in an exciting time – a time

where developments, innovations and significant breakthroughs are occurring at an exhilarating pace.

It is a pace that can only increase, spurred on with further advances in complementary technologies and materials. Driven by clinical need, these advances are proving to make positive real impacts in terms of more accurate diagnosis, reduced operating periods and enhanced patient outcomes.

Right now, it is critical that researchers, clinicians, industry and regulators work together to ensure that there are pathways for these personalised treatments to reach patients and, in turn, benefit our national health systems. ☺

*Dr Stephen Beirne is a Senior Research Fellow at the University of Wollongong's, Intelligent Polymer Research Institute (IPRI) and an Associate Investigator with the ARC Centre of Excellence for Electromaterials Science (ACES). Since 2010 Dr Beirne has led the development of additive fabrication facilities at IPRI while Additive Fabrication Manager for the Australian National Fabrication Facility (ANFF). His research focuses on the application of advanced fabrication techniques in the areas of energy and medical bionics through development of additive fabrication strategies, technologies and materials. He was awarded a PhD in 2008 by the School of Mechanical and Manufacturing Engineering, Dublin City University.*



BY RAJESH VASA AND MAHESWARI CURUMSING  
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# SofiHub eases digital assisted living concerns

**THE CRISIS IN AGEING** The importance of users' emotional expectations in the acceptance of technology can neither be ignored nor underestimated.

**A** As human life expectancy increases and people live well into their 80s and 90s, the challenges of aged care become more immediate and pronounced. The supply of well-regulated, cost-effective and suitable aged-care facilities and communities may not be able to keep up with demand.

These are strong socio-economic reasons to encourage and assist older people to live at home for as long as possible. However, given their physical and mental circumstances, many elderly people do require care and assistance.

For more than a decade, several smart home technologies have been developed to provide ambient assisted living to support a growing number of elderly people to continue to live in their homes for a longer period.

However, most people are still not fully engaged with the idea of having technology rather than human beings to assist them. One of the main issues regarding the adoption of these technologies is linked to the way people perceive the technology – concerns around privacy and confidentiality are recurrent in many studies.

In some studies, elderly adults talk about how these technologies – in particular, the wearable devices such as the emergency alarm pendant – make them feel old, frail, stigmatised and a burden on society.

## EMOTION MATTERS

Studies show that inadequate consideration of users' emotional expectations is one of the major causes for software project failure.

As social beings, people have social and emotional expectations from the system,

*“As social beings, we often have loftier needs, such as to experience social connection and empathy, to care for others and be cared for, and to share pleasure. These particular types of social requirements cannot be easily reduced to functional specifications for information provision.”*

– J. Paay et al (2009)

which software engineers often fail to take into account.

In addition, the current software methodologies fail to provide adequate guidance on how to incorporate users' social and emotional needs when constructing software – so these needs are very often ignored or trivialised.

The importance of users' emotional expectations with regards to the acceptance of technology can neither be ignored nor underestimated.

We have developed, in Australia, a new smart home technology for digital assisted living called SofiHub. It is a non-intrusive solution that monitors residents' behaviour and engages with them whenever there is a need.

The system consists of an intelligent data-processing platform, low-cost sensors, a home-based computing device and a multi-modal end-user interface. It uses network-connected low-cost sensors to create an ambient living environment that can learn and adapt to the user's behaviour.

The goal of this system is to provide reminders (hydration, medication), identify potential security risks (back door has been left open), identify anomalous situations, and automate the physical environment (heating, cooling).

The initial phase of this system was piloted in the homes of elderly people (aged 65 or over) to test the technical functionality of the system as well as to examine the human-computer interaction between the participants and SofiHub.

A principal focus of this project was centred around addressing users' emotions in perceiving and using such technology – a critical factor for long-term adoption.

SofiHub helps in alleviating loneliness among elderly people. The data collected from the interviews and questionnaires throughout the trial showed that most of the participants were willing to use this technology.

Their main concerns were related to the purchase cost and the response time in generating an alert in cases of an emergency, such as a fall or heart attack.

The trial findings also revealed that properly designed technology addresses users' emotional goals.

The SofiHub solution makes users feel safe, supported, cared about and reassured. It reduces their loneliness and is well integrated in their lives. People said they actually liked the periodic voice-based messages and looked forward to them, in particular, the morning messages.

# Clunies Ross Awards

## 2017 Brisbane

The Awards are an initiative of The Australian Academy of Technology and Engineering (ATSE). They are the only Australian headline awards for science and technology which highlight the hard work, extraordinary risks and long-term commitment needed to achieve, through commercialisation, the practical marketplace impact on applied science and technology.

THE 2017 ATSE INNOVATION DINNER WAS PROUDLY SUPPORTED BY:



Dedicated to a better Brisbane



Australian Government  
Department of Industry,  
Innovation and Science



Australian Government  
Department of Defence  
Science and Technology



Australian Government



Australian Government



The Academy congratulates the 2017 ATSE Clunies Ross Awards winners

KNOWLEDGE COMMERCIALISATION AWARD

**Mr Darryn Smart**

Group Leader, Communications and Electronic Warfare,  
Department of Defence Science and Technology

INNOVATION AWARD

**Professor Mike Xie FTSE**

Director, Centre for Innovative Structures and Materials  
RMIT University

ENTREPRENEUR OF THE YEAR AWARD

**Professor Andrew Wilks FTSE**

Co-Founder & Executive Chairman  
SYNthesis med chem Group

AUSTRALIAN ACADEMY OF  
TECHNOLOGY AND ENGINEERING

A SofiHub user, with the device in the foreground.

To ensure users did not ignore messages and to keep attention, we added multiple variations to these messages (in both words and intonation). The feedback from these trials was that these variations were well received.

Users' anticipation and looking forward to messages may potentially be linked to their feeling of loneliness. Studies show that, in the later stages of life, many elderly people feel very lonely due to various factors such as the death of people close to them and health-related issues, which pose barriers to maintaining or creating new relationships.

Under these circumstances, while they prefer to prolong their stay at home, they also crave company.

Our study revealed that the messages (generated by artificial intelligence) made the elderly people feel as if 'someone' was in the house and looking after them. They felt that 'someone' cared about them and greeted them when they woke up every morning.

The findings highlight two main issues:

- 1 Older adults feel lonely living by themselves.
- 2 Technology that considers the emotional aspects in its design are critical to ensure acceptance, especially within the context of a home. ☺



*"In a way, it feels as if there's somebody looking after you ... A guardian angel. ... It feels less lonely."*

– Trial participant

*Professor Rajesh Vasa is a Professor of Software and Technology Innovation at Deakin University and Deputy Director of the Deakin Software and Technology Innovation Lab (DSTIL), with more than 20 years' experience spanning both industry and academia with deep skills in data science, artificial intelligence and complex software systems design. Professor Vasa is passionate about solving high-impact problems. Recent work includes building intelligent homes for aged care, reducing traffic congestion, deep learning and neural networks in healthcare, and automating the process of innovation. He specialises in using technology to create innovative digital solutions.*

*Ms Maheswari Curumsing is a research fellow at Deakin University's DSTIL. She holds a Bachelor's Degree in Information Systems and a Master's degree in Software Engineering. Her PhD is in the area of Software Engineering, more specifically, emotion-oriented requirements engineering. She has more than 12 years' experience in software engineering in industry, research and academia. Since she started her PhD in 2013, she has been heavily engaged in large industry- and government-funded projects, including smart home technologies for the elderly. Her main research focus is on capturing users' emotional expectations and incorporating those expectations within the software development life cycle.*

## DIGITAL HEALTH TECHNOLOGIES FACING A COST CHALLENGE

Australia needs to embrace digital health technologies and focus on data integration and standardisation.

But a major challenge to optimising these technologies is cost – and unless these technologies are subsidised by the government, only a small proportion of the population will be able to afford these treatments, creating equity issues in the healthcare system.

These are key findings from the 2017 ATSE National Technology Challenges Dialogue 'The Crisis in Ageing - Technology to manage the challenges in healthcare'.

Dialogue discussions identified that new technologies were being developed to address emerging and existing healthcare issues but, unlike in other sectors, these technologies often did not necessarily lead to cost savings. They also established that technology was widely used in hospitals to prolong life, but few technologies addressed quality of life, partly due to limited measurement of technologies' return on investment in terms of quality of life.

The Dialogue identified four major challenges that Australia must tackle in order to achieve a more efficient, reliable and equitable healthcare system:

- community lack of trust in the system;
- lack of data integration;
- regulation; and
- development and uptake of technologies by the sector.

It noted that:

- most hospitals across Australia still predominantly use hand-written notes and fax machines to collect patient information (often for regulatory reasons), along with other outdated systems;
- while Australia had a strong track-record of conducting high-quality research in the health sector, it was well behind in the final implementation stage in terms of translation and commercialisation; and
- widespread upgrading to new health technologies will require significantly greater investment from both the public and private sectors.

In an Action Statement resulting from the Dialogue, ATSE recommends three steps necessary to achieve better use of health technology:

- 1 Standardisation and integration of data collection and sharing.
- 2 Consumer empowerment.
- 3 Greater investment in preventative technologies, to improve quality of life and reduce healthcare costs.

# ATSE IN ACTION

## Clunies Ross Awards for top innovators

Top honours for Australia's foremost visionaries were presented at the ATSE Innovation Dinner in Brisbane in June when the prestigious Clunies Ross Awards, Australia's premier innovation commercialisation awards, were presented to a select group of Australia's pre-eminent innovators.

The Clunies Ross Awards have been running since 1991 and winners have included many Australians who have become household names through their achievements in applying technology for the benefit of Australia and the world.

Medical research, preventing injuries to soldiers in action and reshaping the way we design and build things were at the forefront at the ATSE Innovation Dinner, attended by more than 350 people, who were welcomed by the Queensland Chief Scientist Professor Suzanne Miller and addressed by the Australian of the Year, Professor Alan Mackay-Sim.



The magnificent Brisbane City Hall.

The Awards were presented at the magnificent Brisbane City Hall by Professor Miller, South Australian Chief Scientist Dr Leanna Read FTSE and Chancellor of the University of Queensland Mr Peter Varghese AO.

The 2017 Clunies Ross Award winners are:

### 2017 CLUNIES ROSS ENTREPRENEUR OF THE YEAR AWARD

Professor Andrew Wilks FTSE, the Melbourne-based co-founder and Executive Chairman of SYNthesis Pty Ltd, is one of few Australian scientists who have stepped outside the security of the academic

environment to focus solely on translating basic research to benefit humankind. His fundamental research on new cell-signalling enzymes, and the resulting new therapeutic



Leanna Read addresses the dinner.



Keynote speaker Alan Mackay-Sim.

## ACOLA HELPS TO SHAPE OUR FUTURE

Maintaining a strong education system and building industries of the future are two of the key findings in the *Securing Australia's Future* book, launched by the Australian Council of Learned Academies (ACOLA).

Securing Australia's Future was a four-year, \$10 million investment to help shape the nation's priorities. It comprised 11 studies, in which ATSE was heavily involved, and was funded by the Australian Research Council.

The final publication, *Securing Australia's Future: Harnessing interdisciplinary research for innovation and prosperity*, explores each of the program's 11 studies and draws out a set of overarching findings on how to ensure Australia's future prosperity.

These include maintaining Australia's strong education system, embracing Australia's relationships in the Asia-Pacific region, and

building industries of the future.

Australia's Chief Scientist Dr Alan Finkel AO FAA FTSE said the Securing Australia's Future project was a valuable way for the Learned Academies to help policy-makers anticipate how developments in science will change the lives of all Australians in the years to come.

"Securing Australia's Future engaged some of the nation's most respected minds on perhaps the country's most critical brief: the path to prosperity in the decades ahead," Dr Finkel said.

"But it's a never-ending mission. Securing Australia's Future also lays the foundation for a follow-up phase of Horizon Scanning reports, which will continue to advise government on the social and economic changes we can expect as Australia contributes to a digital and global economy."

# ATSE IN ACTION

blood cancer drugs he and his team have developed, promise to continue to profoundly impact the lives of hundreds of thousands of patients worldwide.

## 2017 CLUNIES ROSS KNOWLEDGE COMMERCIALISATION AWARD

Mr Darryn Smart, Group Leader, Cyber and Electronic Warfare Division, Defence Science and Technology Group (DSTG), has developed novel devices to counter improvised explosive devices (IEDs) and protect Australian soldiers and vehicles as well as those of coalition partners. He and his team at the DSTG in South Australia have designed, developed and produced four unique and highly advanced systems that have been commercialised, with an estimated benefit of \$64 million – showing how Australia's cutting-edge technological development can make an impact on the global stage.

## 2017 CLUNIES ROSS INNOVATION AWARD

Professor Mike Xie FTSE, Director of the Centre for Innovative Structures and Materials at RMIT University, has developed techniques widely used across diverse industries, including engineering, architecture, biomedicine and materials science, which have significantly reduced the weight and associated energy consumption of motor vehicles and aircraft, as well as enabled strikingly elegant bridge and building designs. He has made significant contributions to the original development



The winners (from left) Darryn Smart, Andrew Wilks and Mike Xie.

and subsequent adoption of a technology known as Evolutionary Structural Optimisation (ESO) and Bidirectional ESO (BESO).

The event and the winners were widely covered in traditional news media and social media. The coverage received a fillip when Defence Minister Senator Marise Payne congratulated Mr Smart on his Award.

"This is a well-deserved recognition for innovations that have delivered significant operational capability for the benefit of ADF, Coalition and partner forces," Minister Payne said.

"The rapid development of unique devices under Defence's force protection program has been both timely and life-saving for security forces threatened by IEDs."

Chief Defence Scientist Dr Alex Zelinsky AO FTSE said Mr Smart's award represented an exemplary success story for innovation, commercialisation and collaboration between



ATSE President Hugh Bradlow and Director Margaret Sheil.

Defence and industry.

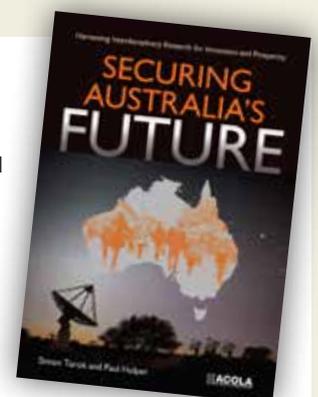
The 2017 Clunies Ross Award sponsors were the University of Queensland, the Queensland Government, the City of Brisbane, four Federal agencies – the Department of Industry, Innovation and Science, DSTG, the Australian Institute of Marine Science and ANSTO – and the universities of NSW, South Australia and Newcastle.

The five key findings from *Securing Australia's Future* are:

- securing a prosperous future needs economic, social and cultural changes that is facilitated by visionary leadership and targeted investments in skills, infrastructure and innovation;
- celebrating our relationships in the Asia-Pacific region will help Australia find new opportunities supported by language, cultural awareness and extended networks and linkages;
- building industries of the future and adapting to change will require increased investment and a commitment to innovation. This includes building better links between business and research, and a capable workforce that combines humanities and science capabilities for creative problem solving;
- maintaining strong foundations in science, technology, engineering and maths education requires us to better engage

- those who are enthusiastic, at all levels and from all backgrounds; and
- for Australia to provide global leadership in environmental sustainability and adaptation, we need to leverage our strength in innovative research, and build our capabilities in urban planning, transport and clean energy solutions.

The book launch, held at the Shine Dome in Canberra, was followed by a panel session with former Chief Scientist Professor Ian Chubb AC FAA FTSE, Academy of the Humanities Executive Director Dr Christina Parolin and Dr Finkel.





# ICM AGRIFOOD AWARD FOR EXCELLENCE IN AGRIFOOD

NOMINATE AN AGRIFOOD TECHNOLOGIST TODAY

## Two of Australia's most innovative young food and agriculture professionals will win the 2017 ICM Agrifood Award

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NOMINATIONS OPEN 15 JUNE AND CLOSE 4 SEPTEMBER 2017.

The ICM Agrifood Award is an early career award for two scientists or technologists who have achieved substantial peer/industry recognition for his/her work in the past five years. The Award is sponsored by ICM Agribusiness, one of Australia's major agribusiness groups, and administered by ATSE. The winners will be awarded at ATSE's Oration Dinner on 24 November 2017 in Sydney.

One female and one male winner will each receive a cash prize of \$5000.

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THE WINNERS WILL HAVE ACHIEVED SUBSTANTIAL RECOGNITION FOR THEIR WORK IN A FIELD CRITICAL TO CONTINUED IMPROVEMENT OF THE OVERALL AUSTRALIAN FOOD SECTOR IN THE PAST FIVE YEARS, AND BE UNDER 40 AT 1 JANUARY 2017 AND:

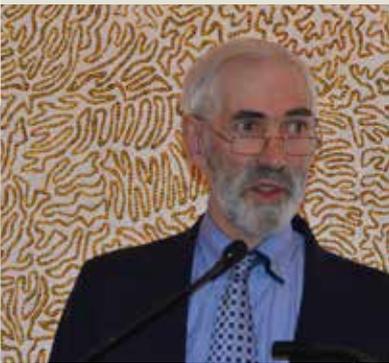
1. Have demonstrated excellence, innovation and impact in a field related to food and agriculture in Australia;
  2. Be acknowledged by peers for outstanding contributions to the food and agriculture sector in the past 5 years; and
  3. Have advanced the standing of the broad profession of agriculture and food.
- 

THE ICM AGRIFOOD AWARD GUIDELINES AND NOMINATION FORM ARE AVAILABLE AT [www.atse.org.au/icmagrifood](http://www.atse.org.au/icmagrifood)

# ATSE IN ACTION

## Big data and genomics are revolutionising health care

Health care is described as the biggest, most important and fastest-growing industry in the world, and it is being rapidly transformed by the integration of genomic data, clinical records and machine learning.



Brian Spies introduces the speaker.

In the past two decades the fastest technological advance in history has reduced the cost of human genome sequencing dramatically, to a few thousand dollars, with further reductions predicted to come – ushering in a new era of personalised medicine and ‘precision health’.

These themes were explored when Professor John Mattick AO FAA FAHMS, Executive Director of the Garvan Institute of Medical Research in Melbourne and a world leader in genomics, addressed an audience of more than 100 at an ATSE lunch in June, the second talk in the NSW Division’s 2017 luncheon series, ‘Big Data – Big Impacts’.

Professor Mattick traced the path of how individual genome sequences will become a standard part of health records, which will revolutionise biomedical discovery, personal health and health system management. Millions of genome sequences – integrated with millions of clinical records, supported by data from wearable devices and the Internet of Things – will create a multidimensional data ecology, facilitated by machine learning and artificial intelligence.

Australia is well placed to be a leader in this revolution, which will have a transformational effect on human health, medical research and ultimately the economy, he said.



John Mattick

## ATSE BACKS THE FINKEL REVIEW

ATSE says accepting the Finkel Review findings will set Australia on a path to reduce emissions, secure our energy supply and, in the longer term, reduce energy prices.

In a response to the public release of the Review, the Academy said – in the absence of an explicit emissions pricing mechanism – the proposal for a low emissions/clean energy target (LET/CET) was sensible and should guide policy in this area, which had been wanting for a long time.

The Review gave Australia a roadmap to use in solving its energy trilemma: to ensure an adequate and reliable energy supply that reduces or removes greenhouse emissions from electricity generation and in the longer term rein in, and then reduce, energy prices.

“The Review recognises that the technologies available today and others progressing to demonstration and

commercial deployment offer the solution to our energy problems,” ATSE said.

“Nonetheless, a technology-neutral approach, that allows the best technology options to be identified and deployed according to market needs, is the key to solving our energy issues.

“On the current technology trajectory, the cost of reliable renewables is reducing rapidly and while the price of electricity is higher in the short to medium term, we will end up with secure, ‘clean’ and affordable energy in the longer term.”

ATSE noted the contribution of its three Fellows to the Review – Australia’s Chief Scientist, Dr Alan Finkel AO FAA FTSE, Ms Chloe Munro FTSE (former Chair of the Clean energy Regulator and the National Water Commission) and Professor Mary O’Kane AC FTSE (NSW Chief Scientist and Engineer).

## ATSE BACKS BROAD EMISSIONS REDUCTIONS

ATSE strongly supports emissions reductions across all sectors while taking steps to balance the economic impacts of this transition.

ATSE’s submission to the Government’s Review of Australia’s Climate Change Policies drew on earlier submissions and publications – and dealt with low-emissions fuels, energy productivity, emissions targets, Australia’s electricity grid, wastewater, agriculture and sustainable urban mobility.

Given that Australia had ratified the Paris 2030 Agreement, action must be taken in Australia to reach the agreed targets, ATSE said – noting the importance of making the necessary investments in accelerated deployment of existing technologies and commercialisation of new low-emissions technologies.

It noted that decarbonisation of Australian energy systems through uptake of renewables would require an independent expert body to develop a long-term strategic plan for “the optimal transition of the electricity sector” and address whole-of-system integration challenges at a national level.

Improving efficiency in Australia’s transport sector, including expansion of mass-transit programs, would greatly improve energy productivity and reduce emissions. A strategic response for upgrading Australia’s infrastructure should be developed.

Electrification of Australia’s transport systems would rely on the decarbonisation of the electricity supply, which could be accelerated by reforms to Australia’s electricity supply systems and markets to deliver reliable, competitive, low-emissions electricity and manage load variability, the submission said.

Lack of policy drivers was partially behind the low uptake in Australia of the many emissions-reduction options available to the resources, manufacturing and waste sectors.

ATSE said it believe the cost of not transitioning to a lower-carbon economy would be higher in the long run.

Research, development, innovation and technology all had a significant role to play in reducing emissions across the Australian economy.

[The submission is online.](#)

# ATSE IN ACTION

## Victoria embraces industry mentoring

Four Victorian universities are breaking new ground to expand the professional horizons of their PhD students before they graduate.



Philip Dalidakis launches IMNIS in Victoria.

La Trobe University, RMIT University, Monash University and The University of Melbourne have engaged with the Industry Mentoring Network in STEM (IMNIS) Victorian MedTech-Pharma program, which was officially opened in June.

IMNIS is an award-winning national initiative of the Academy, connecting high-profile industry leaders with motivated PhD students in a one-year mentoring program.

With funding from major partner MTPConnect, the IMNIS MedTech-Pharma program is rolling out across Australia, with support from consortium partner AusBiotech.

(MTPConnect is a not-for-profit organisation that aims to accelerate the rate of growth of the medical technologies, biotechnologies and pharmaceuticals sector to achieve greater commercialisation and establish Australia as an Asia-Pacific hub for MTP companies. It was formed in November 2015 as part of the Federal Government's \$250 million Industry Growth Centres Initiative.)

The guest speaker was the Victorian Small Business, Innovation and Trade Minister Philip Dalidakis, who discussed how mentors had helped accelerate his career.

He also emphasised the tremendous value of the STEM sector and how STEM infiltrated every part of our lives, as well as the growth potential of the medical technologies and pharmaceuticals industries in Victoria.

IMNIS Executive Director Dr Marguerite Evans-Galea said: "These four universities have demonstrated outstanding leadership by offering their PhD students the golden opportunity of engaging with industry leaders to not only get sage advice and become more informed about the industry sector, but also to extend their professional network beyond academia."

IMNIS mentees learn about commercialisation, start-ups, entrepreneurship and innovation, and the professional skills needed to lead and excel within the STEM ecosystem. For mentors, IMNIS is an opportunity to 'give back' and contribute to the professional development of the next generation of STEM leaders.

IMNIS won a prestigious B/HERT Best Higher Education and Training Collaboration Award in 2016.

IMNIS was kick-started by a small group of Foundation donors and their friends from a range of STEM-related industries who, with a common vision to foster an innovation culture, shared their time, expertise and money.

Working with ATSE, they ran three successful IMNIS pilots in Victoria, South Australia and Western Australia in the past two years. IMNIS would not have got off the ground without the generous support, energy and time of:

- Professor Paul Wood FTSE and Ms Ronnie Wood;
- Dr Tony Radford AO and Ms Deborah Radford;
- Mr John Kirby AM;
- Professor Peter Lilly FTSE; and
- Professor Mike Miller AO FTSE.

A number of Academy Fellows participate as mentors, advisers and champions.

## STEM EDUCATION NEEDS IMPROVEMENT

Australia needs to improve its approach to science, technology, engineering and mathematics (STEM) education to underpin its prosperity, its capacity to meet national challenges and its global competitiveness. Improved quality and reach of STEM education are vital for sustainable wealth creation in Australia, which will be driven by science and technology. These are key points made by ATSE in its submission to the House of Representatives Standing Committee Inquiry into School-to-Work Transition.

ATSE recommended that the Inquiry findings:

- note the changing Australian workplace and the needs of the current generation of students into the future;
- promote curriculum design that meets the needs of students in future work scenarios;
- move to ensure initial teacher education and training for STEM teachers require a Bachelor's Degree, with appropriate STEM major, along with either undergraduate or postgraduate qualifications in teaching;
- encourage interdisciplinary learning environments for STEM through recognition of the effectiveness programs, such as ATSE's STELR program; and
- back investment in programs that promote careers that require STEM skills.

The ATSE submission is online at [Publications>Submissions>Education](#)

## ATSE GOES TO APEC IN HANOI

The Academy participated in the APEC Policy Partnership on Science, Technology and Innovation (PPSTI) meetings in Hanoi in May, represented by ATSE's Executive Manager Policy and Projects Dr Matt Wenham. APEC is a forum for 21 Pacific Rim member economies that promotes free trade throughout the Asia-Pacific region. ATSE's presence at APEC has the potential to lead to new funding opportunities to run international workshops and programs at a bilateral and multilateral level. ATSE director Dr Rosalind Dubs FTSE attended and chaired a session at the APEC Women in STEM Workshop the same week. She is also a member of the Performance and Audit Review Committee of Science in Australia Gender Equity (SAGE), of which ATSE is a partner. The meeting was also attended by IMNIS Executive Director Dr Maggie Evans-Galea, who is a member of the SAGE Expert Advisory Group, Chair of the Australian Science and Innovation Forum and Co-Founder of Women in STEMM Australia.

# WOMEN IN TECHNOLOGY

## Ada Lovelace Medal rewards outstanding engineer

Nominations for the Ada Lovelace Medal for an Outstanding Woman Engineer, won in its first year in 2016 by Professor Mary O'Kane AC FTSE, closed on 21 July.

The medal is awarded by the University of NSW's Faculty of Engineering and is named for Augusta Ada Byron (1815–52), Countess of Lovelace, an English mathematician widely considered to be the first computer programmer.

The recipient will have a minimum of 15 years of increasingly important engineering experience, contributing significantly to a field of engineering in Australia and/or internationally through technical achievements and leadership.

Nominations are open to female engineers from industry or academia who are Australian citizens or permanent residents and graduates of any recognised university in Australia or overseas.

The Ada Lovelace Medal is one of the UNSW Women in Engineering Awards, presented to attract more female high school leavers to consider engineering as their preferred career.

There are two other major awards, both named for ATSE Fellows, with \$5000 prize money. Both are restricted to and recognise the achievements of female UNSW Engineering graduates only.



The Ada Lovelace Medal.

The **Judy Raper Award for Leadership in Engineering** rewards sustained and significant contribution through demonstrated leadership within the discipline/profession in Australia.

Effective leadership is characterised by passion and commitment, setting bold objectives and achieving results, and, most importantly, motivating and mobilising the talent of others for the benefit of the discipline/profession and the community at large.

This award is named for University of Wollongong Deputy Vice-Chancellor (Research), Professor Judy Raper FTSE.

The **Maria Skyllas-Kazacos Young**



Mary O'Kane, 2016 winner of the Ada Lovelace Medal.



Maria Skyllas-Kazacos



Judy Raper

**Professional Award for Outstanding Achievement** is named for Professor Maria Skyllas-Kazacos AM FTSE, Emeritus Professor, Chemical Engineering and Industrial Chemistry at UNSW, and recognises significant achievement in her field by a candidate 35 years of age or younger at the time of nomination.

## FELLOWS HELP DRIVE WOMEN ENGINEERS

Two Fellows were key players in a Monash University event to celebrate International Women in Engineering Day in June with a Future Women Leader's Conference aimed at female engineering academics. Monash's second Future Women Leader's Conference invited 50 high-achieving young female engineering academics to attend workshops presented by distinguished engineering academics from local universities.

Professor Ana Deletic FTSE, the outgoing Associate Dean (Research), and Professor Karen Hapgood, Dean and Head of School of Engineering at Deakin University, developed the concept to help young female engineering academics navigate their way throughout their careers.

The keynote speaker was Professor Doreen Thomas FTSE, Head of the School of Electrical, Mechanical and Infrastructure Engineering at the University of Melbourne, who spoke about her career and how she challenged the status quo through taking on and succeeding in traditional male roles. The conference featured a range of workshops

that were designed to inspire, encourage and inform these high-achieving engineering academics.



Ana Deletic

# WOMEN IN TECHNOLOGY

## Targeting the gender participation gap

The Australian Government has launched 'Towards 2025: An Australian Government strategy to boost women's workforce participation', which aims to reduce the gender participation gap by 25 per cent by 2025.

The Minister for Employment and Minister for Women, Senator Michaelia Cash, launched the document.

"Getting more women engaged in work is an economic and social priority," Senator Michaelia Cash said when launching the document.

"Boosting women's workforce participation is essential to raising living standards and securing Australia's future prosperity. It has the potential to add up to \$25 billion to the Australian economy. The workforce gender participation gap is narrowing, but more work needs to be done if we are to achieve our target of reducing the gap by 25 per cent by 2025," she said.

*"Getting more women engaged in work is an economic and social priority."*

– Michaelia Cash



**Australian Government**  
**Australian Research Council**

**Senior Executive Service Band 1**  
**Executive Director**  
**Engineering and Information Sciences**

The Australian Research Council (ARC) is a national agency that funds research through the National Competitive Grants Program (NCGP) to promote the conduct of the highest quality fundamental and applied research and research training for the benefit of the Australian community. It also provides advice to the government on research funding and policy, as well as the Excellence in Research in Australia (ERA) program.

Reporting to the Chief Executive Officer, the ARC is seeking an Executive Director with expertise in Engineering and Information Sciences. The Executive Director will contribute to the management of the NCGP, deal with academic matters and government initiatives and lead, develop and implement schemes and other strategic initiatives. The successful applicant will represent the ARC and liaise with the research community and industry in regard to ARC research funding and initiatives.

This is a senior opportunity, which will suit individuals able to demonstrate national and international research leadership in a relevant area of Engineering and Information Sciences. Applicants should demonstrate well developed management skills, sensitivity to the prevailing social and political environment, and an understanding of the values of the Public Service. Personal drive and integrity are essential as are the ability to lead, contribute strategic thinking, achieve outcomes, cultivate effective working relationships and communicate with influence. Suitable backgrounds include universities, private sector research and/or public sector research agencies.

**For a confidential discussion contact Ms Leanne Harvey, Executive General Manager (02) 6287 6606. Applications should be forwarded by Friday 15 September 2017 to [recruitment@arc.gov.au](mailto:recruitment@arc.gov.au) or GPO Box 2702, Canberra ACT 2601.**

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## WORKSHOP PRODUCES EQUALITY PLANS

A 2016 workshop in India convened by the Australian, Indian and UK governments has generated cross-national recommendations for achieving gender equality in science, technology, engineering, mathematics and medicine (STEMM).

The workshop was supported by Science in Australia Gender Equity (SAGE), a partnership between ATSE and the Academy of Science promoting gender equity in academic and research organisations in Australia.

### RECOMMENDATIONS INCLUDED:

- 1 Develop a proposal to the Indian Science Academies' inter-academy panel to introduce an Athena SWAN framework to India.
- 2 Develop a strategy to leverage corporate social responsibility to support female internships across all three countries.
- 3 Develop a common set of messages for a digital campaign to promote women in STEMM across Australia, India, and the UK.
- 4 Consider developing a proposal to expand trilateral cooperation on promotion of Women in STEMM to the Commonwealth.
- 5 Strengthen coordination and development of and support for bespoke professional leadership programs for Women in STEMM.
- 6 Build an entrepreneurial support network under the STEMM professional and academic associations in India, Australia and the UK.
- 7 Explore opportunities for university/industry collaboration between India, Australia and the UK.
- 8 Identify common gender STEMM regional and international data sources that provide consistent, systematic reporting of gender data and are available for the three countries.

## FELLOWS TALK WATER

Ms Karlene Maywald FTSE, Strategic Adviser – Water Opportunities, South Australian Government, and Professor Cynthia Mitchell FTSE, Institute for Sustainable Futures, University of Technology Sydney, were presenters at the inaugural South Australian Women in Water Breakfast in Adelaide.

Following individual presentations to the crowd of 80, they participated in an open panel discussion during which they shared their views on the challenges for women in the water industry and their advice for continuing success into the future.

# WOMEN IN TECHNOLOGY

## Thirty-five Australian women on Antarctic expedition

ANU theoretical physicist Professor Susan Scott will be one of 35 Australian women joining an international team of 80 women on a three-week female expedition to Antarctica in February–March 2018.

The expedition is part of the Homeward Bound program, which aims to heighten the impact of women with a science background in order to influence policy and decision-making.

Homeward Bound's vision is, within 10 years, to equip a 1000-strong global collaboration of women with science backgrounds to drive policy and decision-making about the future of our planet.

This envisions a geographically, ethnically and scientifically diverse group of women to engage in a philanthropically funded, year-long program to develop their leadership and strategic capabilities, using science to build conviction around the importance of their voices.

The first Antarctic Expedition, in December 2016, attracted 76 participants.

The 80 women selected for the second Homeward Bound Program all have a background in science.

Apart from Professor Scott, Australian participants include:

- Dr Sarah Hamylton, geographer and a senior lecturer, University of Wollongong;
- Dr Karen Alexander, research fellow in ecosystem-based management, University of Tasmania;
- Dr Megan Oaten, senior lecturer, Menzies Health Institute, Griffith University;
- Dr Sarah Hanieh, paediatrician and researcher, Peter Doherty Institute for Immunity and Infection, University of Melbourne;
- Dr Madeline Mitchell, postdoctoral fellow, CSIRO Agriculture and Food, Canberra;
- Dr Veronique Florec, postdoctoral researcher in environmental and resource economics, University of WA;
- Dr Ellen Moon, research associate, Southern Cross GeoScience, Southern Cross University;
- Dr Romy Zyngier, Acting Program Manager Bushfire Monitoring, Evaluation and Research, Department of Environment, Land, Water and Planning, Victoria;
- Dr Sophie Adams, psychiatrist and Clinical Director, Clinical Division Orygen, The National Centre for Excellence in Youth Mental Health, Victoria; and
- Dr Rebecca Doyle, a senior lecturer, Faculty of Veterinary and Agricultural Sciences, University of Melbourne;



Susan Scott



Sarah Hamylton



Megan Oaten

## SAGE SYMPOSIUM REVIEWS PROGRESS

The 2017 SAGE (Science in Australia Gender Equity) Symposium will discuss ways of enhancing the roles of women in Australian society, particularly in the research environment. The Symposium will be held in Brisbane on 5 and 6 September.

Day 1 topics are *Changing Culture from Within*, *Value in Equality*, *Empowerment for All* and *Collective Action*.

Day 2 is an event for SAGE program participants that will review the SAGE program in a session titled *Pressure Testing the Peer Review Process*, which will be followed by three workshops focused on *Action planning*, *Building inclusive environments in STEM workplaces* and *Capacity building/professional development*.

SAGE is a program of activities designed to improve gender equity and diversity in Science, Technology, Engineering, Mathematics and Medicine (STEMM) through a focus on these disciplines at Australian tertiary and research institutions, using the Athena SWAN program.

It is a partnership between ATSE and the Australian Academy of Science,

The Athena SWAN Charter is an evaluation and accreditation program that has been running for more than a decade in the UK, enhancing gender equity in STEMM. Through bronze, silver and gold awards, the Charter recognises excellence in employment practices that advance and promote the careers of women and gender minorities in STEMM subjects.

The SAGE Pilot of Athena SWAN involves 40 charter members, including 30 universities, six medical research institutes and four government science organisations.

The SAGE Pilot has adapted the UK processes for the Australian context, running training workshops on gender equity and providing gender equity accreditation for participating universities, medical research centres and Government research organisations.

# Enhancing Australia's prosperity through technology and innovation

The Australian Academy of Technology and Engineering (ATSE)

ATSE is made up of some of Australia's leading thinkers in technology and engineering. One of Australia's four Learned Academies, it's an eclectic group, drawn from academia, government, industry and research, with a single objective in mind – to apply technology in smart, strategic ways for our social, environmental and economic benefit.

To achieve that goal, ATSE has formed a variety of expert, independent forums for discussion and action – platforms to move debate and public policy on issues concerning Australia's future. These focus on agriculture, education, energy, health, infrastructure, innovation, mineral resources and water – and increasingly on climate change mitigation and ICT issues. ATSE is keenly aware of the international collaboration necessary to ensure that Australia is abreast of world trends.

It's an open, transparent approach – one that government, industry and community leaders can trust for technology-led solutions to national and global challenges. Each year, the Australian Government recognises the importance of the work we do by awarding the Academy an establishment grant to help with:

- Fostering research and scholarship in Australia's technological sciences and engineering;
- Providing and conducting administrative support, workshops, forums and events to enable the Academy and its Fellows to contribute on important national issues;
- Managing the development and execution of our programs; and
- Supporting relationships with international communities.

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## Data61 has 70 cyber research projects

CSIRO's Data61, Australia's largest data innovation group, has more than 70 cyber security research initiatives active across the network of universities, research institutions and government sectors.

Marking its first year of operation, Data61 claims it has made significant strides in support of the Government's Cyber Security Strategy. Adrian Turner, CEO of Data61, said cyber security must be at the forefront of the national agenda.

"Our priority is to help create a globally competitive, domestic cyber security sector, and we're committed to continue driving the momentum that's built through our team,

network partnerships and R&D projects," Mr Turner said.

"Cyber security is a core enabler for scaling existing Australian industries and for seeding new ones. It's a rapidly evolving landscape that will always value new thinking and new approaches.

"We're confident that by maintaining collaborative efforts in the cyber security sector, Data61 will help catalyse the next phases of the Australian cyber security sector and the digital economy more broadly. Australia has all the ingredients to succeed," Mr Turner said.

Key Data61 activities addressing the Cyber Security Strategy this year include:

- development of Platforms for Open Data

*'Significant strides' in cyber security.*

(PfOD) to enable data sharing, while maintaining data privacy and integrity;

- creation of a nationally recognised cyber security curriculum, developed in partnership with the Australian Institute of Company Directors (AICD);
- activating the SINET61 network with the SINET61 Sydney Summit drawing in over 200 attendees and the SINET Investment Forum in Melbourne attracting more than 50 visitors;
- more than 70 cyber security research projects;
- a \$9.3 million partnership with the Defence Science and Technology Group (DSTG) to establish collaborative research projects with nine Australian universities around cyber security;
- opening the Victorian Cyber Security and Innovation Centre in Melbourne; and
- launch of two blockchain reports for the Federal Treasury to inform the industry of the opportunities, security and privacy risks of blockchain technology, to encourage dialogue between researchers, government and industry.

## OVER 80,000 NEW IT JOBS IN FIVE YEARS

Australia's 'digital boom' has seen 40,000 technology jobs created over the past two years (2015-16) with an additional 81,000 jobs to be filled by 2022 to fuel future technology-led growth. These figures emerge from the 2017 *Digital Pulse Report* by the ACS, the professional association for Australia's IT sector, prepared by Deloitte Access Economics.

"Technology skills are fast becoming the engine room of the Australian economy," said ACS President Anthony Wong. "To fast-track our nation's digital transformation, and ensure the ICT skills base is there to meet demand, we need a clear strategy and dedicated investment focus in this area.

"The ACS is actively championing the uptake of coding in schools, better support for teachers in the delivery of emerging technology areas, the establishment of multidisciplinary degrees and relevant training programs to help to build a pipeline of workers with valuable ICT skills.

"In a skills shortage environment, skilled migration is an important lever for developing competitive advantage for the nation. However, it needs to be targeted, and needs to address the genuine skills gaps in the domestic market, while ensuring migrant workers are not exploited.

"Australian employers are placing a high value on ICT skills against the backdrop of digital technologies being increasingly fundamental to a thriving economy," said Deloitte Access Economics partner John O'Mahony. "As business disruption becomes more widespread, businesses need a strong ICT core to manage change – making ICT workers and ICT skills the bread and butter behind that change."

## DIPA WILL ANALYSE 'DATA ASSETS'

The Government will establish data analytics teams to deliver improved, evidence based programs and policy under its new Data Integration Partnership for Australia (DIPA) initiative, funded by \$130.8 million over three years, through the Public Sector Modernisation Fund announced in the 2017 Budget.

DIPA aims to maximise use of the Government's vast data assets, allowing "cost-effective and timely insights" into data that is already available.

It will coordinate specialised teams focused on social, industry, environmental and government-efficiency policies.

It plans to identify and prevent risk of disability in the workplace, support ongoing workforce participation for those with a disability, and better understand the effects of medications to avoid adverse reactions.

The Government says DIPA will create high-value national data assets to build longitudinal data about populations, businesses, the environment and government to inform the development and evaluation of policies and programs.

It says the data will be de-identified and analysed in controlled environments governed by strict processes and legislation and DIPA aims "to benefit all Australians through improvements in social and economic welfare and better outcomes for businesses".



BY TREVOR DANOS  
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# Serendipity plays a crucial role in science

**T** There is plenty of evidence that serendipity has played and continues to play a crucial role in science. One of the best-known examples is the discovery of penicillin by Sir Alexander Fleming in 1928. On this occasion serendipity presented itself via a damp and readily contaminated laboratory, lower than average summer temperatures, some mould and a two-week holiday absence. These occurrences, and not planned research, delivered to the world its first antibiotic.

Fleming was awarded the Nobel Prize but this is not the only Nobel Prize given to serendipity. Arno Penzias and Robert Woodrow Wilson won the 1978 Nobel Prize for the discovery of cosmic microwave background radiation and thus proof of The Big Bang, all because the sensitive radio

astronomy antenna they had switched on was subject to unexplained radio noise. Interestingly, it was initially thought the cause was bat droppings, but the noise persisted even after the antenna was cleaned.

Even Alfred Nobel was not immune from serendipity. Nobel's own discovery of dynamite was accidental. Nobel put a popular but flammable ointment on a cut finger. The ointment of collodion was painful and unpleasant so he mixed it, as one does, with nitroglycerine and made gelatinous dynamite.

My personal favourite example is the discovery of infrared radiation by Sir William Herschel in 1800. He laid out a series of thermometers to measure the temperature of different wavelengths of visible light as it passed through a glass prism. He accidentally left some spare thermometers off to the side, beyond the range of the rainbow. The

temperature gradient continued beyond his experiment across to those spare thermometers. Thus was discovered infrared radiation.

There are other examples of serendipity at work:

- Pfizer's drug called UK92480, intended to treat patients with angina by relaxing blood vessels, had an unexpected side-effect below the belt, and became Viagra; and
- in 1879, Russian chemist Constantin Fahlburg forgot to wash his hands after a day spent reacting coal tar with phosphorus, ammonia and other chemicals. His evening meal, prepared by hand, tasted unusually sweet. The coal tar accidentally delivered saccharin.

These examples remind us that science in the real world is messy and untidy. The processes of science are not nearly as neat

## ANSTO PURSUES PARTICLE THERAPY CANCER TREATMENT

**A** National Particle Therapy and Research Centre would provide all Australians with access to the very latest in cancer treatments, delivering proton therapy and cutting-edge carbon therapy, which is being used around the world to improve outcomes for patients with previously untreatable cancers. The Australian Nuclear Science and Technology Organisation (ANSTO), experts from Italy and clinicians from NSW met recently to explore how the full range of particle therapy treatments may be made available to Australians.

Their discussion followed the announcement of a \$68 million Budget contribution to establish a proton beam therapy (PBT) centre in Adelaide – an important first step in Australia to establishing a capability to deliver particle therapies to treat cancers in Australia.

“Carbon ion therapy is a game-changer. It has the potential to significantly improve patient outcomes and take Australia into the community of nations adopting this advanced approach,” said Dr Adi Paterson FTSE, CEO of ANSTO.

“It is essentially a process in which a high-energy particle beam, delivered from a high-tech accelerator, can very precisely deliver a dose of radiation targeted to a tumour, matching its shape and size. “Carbon ion therapy offers the potential to treat disease three times

### WHAT IS PARTICLE THERAPY?

Conventional radiotherapy uses high-energy radiation, usually photon beams, to destroy cancer cells or impede their growth and it has a major role in modern cancer management.

Particle therapy is a class of treatment that kills cancer cells using protons or other charged ions, such as carbon, with minimal side-effects.

Carbon therapy patients require fewer treatments, experience fewer side-effects and achieve better outcomes compared to current treatment options, making this an exciting development in the particle therapy offering.

more effectively than conventional radiation therapy, in fewer treatment sessions and with little damage to surrounding healthy tissues.”

Dr Sandro Rossi, the Director-General of Italy's National Centre of Oncological Hadrontherapy, said it focused on treatment of radio-resistant or inoperable tumours and broader research.

“Patients who receive particle therapy treatments are often at a point of little hope – after they have been told that surgery isn't an option, or conventional radiation therapy has been unsuccessful,” he said.

and logical as conveyed in journal articles. Fleming is said to have famously remarked, upon realising his discovery, "That's funny".

In my view, it is wrong to superimpose rational processes on experiments. Many, if not most, discoveries in biology could not have been arrived at through reason alone. It is not an overstatement to say that many of the most important and revolutionary

in the context of scientific discovery there is an implicit reference to or requirement for intelligence, keen perception, acute powers of observation or sound judgment. In the context of science, serendipity is a capability, not merely a happening. One might say that serendipity, in the context of science, does not work for dullards.

So while serendipity is devoid of logic and

memoirs, their indebtedness to chance.

Good research needs to recognise the human cognitive function and good researchers cannot be tone deaf to the role and importance of serendipity.

In conclusion:

**1** Serendipity does exist in regular and tangible ways, which in itself is astonishing given the scale and scope of systemic research.

**2** In strongly empirical fields, such as astronomy, chemistry and medicine, serendipitous findings are the most frequent and this is without taking into account the inevitable underestimation of serendipity.

**3** Researchers who use and respond to serendipity generally have the admirable qualities of open-mindedness, perceptiveness, curiosity, intuition, flexibility, diligence and humour, which is not always the case with planned research. ☺

*Mr Trevor Danos AM is a lawyer, company director and a strategic adviser. He is a past director of the Civil Aviation Safety Authority, TransGrid and Endeavour Energy and a past member of the Cooperative Research Centres (CRC) Committee. He is chair of the NSW Treasury Social Investment Expert Advisory Group and a member of the Australia-New Zealand SKA Coordination Committee for the Square Kilometre Array. He is chair of Northern Sydney Local Health District. He wrote The Pursuit of Excellence: A History of the Professor Harry Messel International Science School.*

## Many, if not most, discoveries in biology could not have been arrived at through reason alone.

discoveries in biology and medicine have a serendipitous element to them.

Some researchers estimate that up to 50 per cent of scientific discoveries are serendipitous. Others think that the percentage might be even higher.

So what is serendipity? It's an exotic-sounding word. It is derived from the old name for Sri Lanka. The word was first used by Horace Walpole in 1754. It brings to mind two concepts: first, a providential, desirable or valuable outcome; and second, an element of accident.

That is the lay or popular meaning, but

predictability, on which traditional scientific behaviour and scientific thinking are based, the beneficiary of the serendipity does need a sufficient brain to be able to contextualise and make use of the accidental finding. As Pasteur observed, chance favours the prepared mind.

The problem we face is that traditional scientific training and thinking favour logic and predictability over chance, and thus serendipity is often overlooked in scientific literature. Yet older scientists who have achieved high honours will readily acknowledge, most especially in their

PHOTO: CARLOS FURTADO/WSLHD CORPORATE COMMUNICATIONS-MULTIMEDIA



*Dr Paterson (right), Professor Verity Ahern from the Princess Mary Cancer Centre, and Dr Rossi in Sydney.*

If Australia were to establish a national particle therapy and research centre that could deliver carbon ions and other types of particle therapy including proton therapy, it would join a small community of leading clinicians and researchers around the world, he said.

"It would deliver not only innovative and potentially life-saving treatments for patients, but cutting-edge research, for example, to understand more about the ways radiation interacts with living tissues," Dr Rossi added.

## SOFTWARE TO HASTEN CANCER DETECTION

**R**esearchers at CSIRO's Data61 are developing a software tool that could significantly improve the detection of angiogenesis – the development of new blood vessels – which is known to precede the growth of cancers.

Earlier detection of blood vessel growth may lead to a faster diagnosis of malignant tumour growth, which is a key factor in successful treatment and patient survival.

In the study, Data61 researchers teamed up with researchers at the Shanghai Institute of Applied Physics to produce images of the brains and livers of mice at various stages of cancer growth.

Using the images, the team developed a robust algorithm to generate an accurate representation of the vasculature, preserving the length and shape information of the blood vessel and its branches.

The new software allows researchers to measure subtle changes in the proliferation of blood vessels, including the number and length of the blood vessel branches, and produces significantly clearer skeletons of the vasculature than previously possible.

# A healthy and protected Australia

Health is continuing to place enormous pressure on Australia's social and economic resources as our population ages and the burden of chronic disease increases.

Working with our partners, our science and technology innovations are protecting Australia from biosecurity threats, enhancing the nation's health system and reducing the burden of chronic disease.

## WE WANT TO WORK WITH YOU

Partner with us to help develop innovative health solutions and create a strong biosecurity system for Australia.

We do the extraordinary every day.  
We imagine, we collaborate, we innovate.

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[www.csiro.au](http://www.csiro.au)





Alert for Zika virus.

PHOTO: SHUTTERSTOCK

## Getting the drop on epidemic outbreaks

A digital disease-detection tool that picked up signals of an outbreak of the Zika virus months earlier than it was officially detected in Brazil has won the UNSW ZikaHACK competition.

The NHMRC's Integrated Systems for Epidemic Response (ISER) sponsored the international challenge for multidisciplinary teams of students to develop a digital tool for early disease detection.

Jitendra Jonnagaddala and Sean Batongbacal (UNSW) and Luan Almeida (Federal University of Alagoas, Brazil) called the winning tool 'Gadyan' (pronounced like 'guardian') – an Aboriginal word meaning Sydney cockle.

Traditionally, disease outbreaks are detected by governments or public health agencies based on the data from routine reporting from doctors, laboratories and hospitals, with checking and re-checking of test results often delaying results.

Mr Jonnagaddala said Gadyan used sophisticated, robust, statistics-based algorithms to generate early outbreak signals using data from Google Trends, Wikipedia and Twitter.

"This was something that hadn't been done for Zika before, and other systems had only used one data source," he said. "For ours we combined all of the data sources and by doing this our system performed better."

The Zika outbreak was officially declared by the Pan American Health Organization (PAHO) in November 2015, but Gadyan detected raw signals in the last quarter of 2014 and second quarter of 2015.

The UNSW-based team members said the involvement of Mr Almeida was invaluable. He had witnessed the outbreak in his region of north-east Brazil and provided local insights and translation.

ISER Director, Professor Raina MacIntyre, said the team won from a field of 11 highly competitive entries, which were judged on their ability to identify Zika early, as well as adaptability and ease of use.

ISER will work with the winning team to further develop the tool for wider global application within its Epidemic Observatory, Epi-Watch.

## MIN GU TEAM MAKES WORLD'S THINNEST HOLOGRAM

An Australian-Chinese research team, led by Professor Min Gu FAA FTSE, of RMIT University, has created the world's thinnest hologram, paving the way towards the integration of 3D holography into everyday electronics like smart phones, computers and TVs.

Interactive 3D holograms are a staple of science fiction – from *Star Wars* to *Avatar* – but the challenge for scientists trying to turn them into reality is developing holograms that are thin enough to work with modern electronics.

Now a pioneering team led by Professor Gu, RMIT's Associate Deputy Vice-Chancellor for Research Innovation and Technology, has designed a nano-hologram that is simple to make, can be seen without 3D goggles and is 1000 times thinner than a human hair.

"Conventional computer-generated holograms are too big for electronic devices but our ultrathin hologram overcomes those size barriers," Professor Gu said.

"Our nano-hologram is also fabricated using a simple and fast direct laser writing system, which makes our design suitable for large-scale uses and mass manufacture.

"Integrating holography into everyday electronics would make screen size irrelevant – a pop-up 3D hologram can display a wealth of data that doesn't neatly fit on a phone or watch. From medical diagnostics to education, data storage, defence and cyber security, 3D holography has the potential to transform a range of industries and this research brings that revolution one critical step closer."

Conventional holograms modulate the phase of light to give the illusion of three-dimensional depth. But to generate enough phase shifts, those holograms need to be at the thickness of optical wavelengths.

The RMIT team, working with the Beijing Institute of Technology (BIT), has broken this thickness limit with a 25-nanometre hologram based on a topological insulator material – a novel quantum material that holds the low refractive index in the surface layer but the ultrahigh refractive index in the bulk.

The topological insulator thin film acts as an intrinsic optical resonant cavity, which can enhance the phase shifts for holographic imaging.

The research is published in the journal *Nature Communications*.

## FIVE IN QS TOP 100

Australia has some of the world's best universities, with five universities ranked in the top 50, according to the 2018 Quacquarelli Symonds (QS) World University Rankings.

The Australian National University was the top-ranked Australian university, securing 20th place in the competitive global rankings, which assess institutions based on their teaching, employability of graduates and research efforts.

The University of Melbourne was placed 41, followed by the University of New South Wales (45), the University of Queensland (47) and the University of Sydney (50).

Others in the top 100 were Monash University (60) and the University of WA (93).

# NEWS

## ASTRO 3D will probe the universe

A new Australian Research Council (ARC) Centre of Excellence will answer fundamental questions in astrophysics, including the formation of matter in the universe, using cutting-edge 3D technology.

The new ARC Centre of Excellence for All-sky Astrophysics in 3 Dimensions (ASTRO 3D), based at the Australian National University, will receive more than \$30 million in funding over seven years through the ARC Centres of Excellence scheme.

“ASTRO 3D will answer fundamental questions in astrophysics, to help build

a picture of the evolution of matter, the periodic table of elements, and energy in the universe from shortly after the Big Bang until the present day,” said ARC Chief Executive Officer, Professor Sue Thomas.

“The Centre will propel Australia to the forefront of astronomical research, to develop and use high-tech instruments that will be crucial for the next generation of giant optical and radio telescopes, such as the Giant Magellan Telescope and Square Kilometre Array.

“ASTRO 3D will involve researchers at institutions across Australia and overseas,

including astronomers, astrophysicists, engineers and computer scientists. The Centre will also nurture young scientific leaders and encourage high-school students interested in STEM sciences through education and outreach programs.”

Researchers based at ANU will work with colleagues at the University of Melbourne, the University of Sydney, Swinburne University of Technology, the University of WA and Curtin University. ANU will also partner with the Australian Astronomical Observatory, CSIRO, the California Institute of Technology, the universities of Oxford, Toronto and Washington (Seattle), the Netherlands Institute for Radio Astronomy, Australia’s National Computational Infrastructure, the Chinese Academy of Sciences and the Heidelberg Institute for Theoretical Studies.



Artist's impression of Pleiades satellite, which meets defence, civil and commercial space imagery requirements.

### DEFENCE GETS BETTER SATELLITE CAPABILITY

The Australian Government will invest \$500 million to improve Australia’s space-based intelligence, surveillance and reconnaissance capabilities, to support ADF operations.

It aims to improve Defence’s access to commercial satellites to provide information to government agencies, to be used to support defence operations, border protection and humanitarian missions.

It supports the Defence Project 799 which was introduced in the 2016 Defence White Paper to enhance Australia’s geospatial-intelligence capabilities.

It will enable imagery from high-end commercial satellites, now in orbit, to be integrated directly into the Australian Geospatial-Intelligence Organisation’s imagery dissemination systems, reducing the time it will take for this imagery to get to the ADF or national security agencies.

A total of \$130 million will be spent on support contracts over the 13-year life of the project, which the Government says will provide commercial opportunities for Australian companies.

## SATELLITE STATION WILL AID DEFENCE

Australian armed forces will receive a major communications boost from the building of a new satellite ground station at Kapooka, NSW.

Defence Industry Minister Christopher Pyne and Defence Minister Senator Marise Payne have announced a \$223 million contract with Northrop Grumman Australia for the acquisition, construction and support of the station, with construction by Hansen and Yuncken due to start later this year. The project is expected to be completed in mid-2021.

“The satellite ground station will enable deployed forces across the Pacific and Indian Ocean region to connect to Defence’s strategic information networks back in Australia,” Minister Pyne said.

Minister Payne said the technology would assist with a range of operations in our region including border protection humanitarian and disaster relief missions.

“The Kapooka ground station will operate in conjunction with a satellite ground station in Western Australia to provide Defence with the level of wideband satellite communications, capacity and survivability needed in the future.

“The system will enable reduced operational response times for establishing and restoring satellite communications services, significantly helping deployed forces,” Minister Payne said.

Boosting our satellite communications.



## Megan Clark to head space review

Former CSIRO chief executive Dr Megan Clark AC FTSE will chair an Expert Review Group appointed by the Australian Government to review the nation's space industry capability to develop a long-term plan to grow the sector.

Announced by Industry, Innovation and Science Minister Senator Arthur Sinodinos AO, The review will consult widely and examine Australia's current capability and areas of comparative advantage, as well as regional and international collaboration within the sector.

It will also consider how the space industry sector aligns with other sectors and Government priorities.

Senator Sinodinos said the review was timely, given the current pace of change

in the international space sector and advances in technologies that provide an environment that encourages commercial investment in space activities.

The Government wanted to ensure the right framework and mix of incentives were in place to assist Australia's growing space industry sector to participate successfully in the global market.

"I believe that Australia can participate in the global space sector and through development of the technical capability and knowledge required for this demanding sector, we will develop skills to grow other advanced manufacturing industries in Australia."

He said the space industry sector had



Megan Clark

been growing at a compound annual growth rate of 9.52 per cent from 1998 to 2015, more than three times the annual growth rate of world GDP in the same period.

Globally, revenue from space-related activities in 2015 was about US\$323 billion.

The review will commence with the first meeting of the Expert Reference Group on 20 July 2017 and will be completed by the end of March 2018.

PHOTO: KIM STEELE

The ASKAP dishes.



## ASKAP FINDS FAST RADIO BURST – FAST!

**A**CSIRO telescope has found its first 'fast radio burst' from space after less than four days of searching.

The discovery came so quickly that the telescope, the Australian Square Kilometre Array Pathfinder (ASKAP) near Geraldton in Western Australia, looks set to become a world champion in this fiercely competitive area of astronomy.

The new fast radio burst finding was published in *The Astrophysical Journal Letters*.

Fast radio bursts (FRBs) are short, sharp spikes of radio waves lasting a few milliseconds.

They appear to come from powerful events billions of light-years

away but their cause is still a mystery. The first was discovered in 2007 and only two dozen have been found since.

The discovery of the new burst, FRB170107, was made by astronomers from CSIRO, Curtin University and the International Centre for Radio Astronomy Research (ICRAR) while using just eight of the telescope's 36 dishes. The discovery is the culmination of a decade of science and engineering development by CSIRO and Curtin University.

FRB170107 came from the edge of the constellation Leo. It appears to have travelled through space for six billion years before slamming into the WA telescope at the speed of light. The burst's brightness and its apparent distance mean that the energy involved is enormous, making it extremely challenging to explain.

To make the most recent detection, the researchers used an unusual strategy. Usually ASKAP's dishes all point at the one part of sky. But they can be made to point in slightly different directions, like the segments of a fly's eye. This multiplies the amount of sky the telescope can see. Eight ASKAP dishes can see 240 square degrees at once – about a thousand times the area of the full Moon.

ASKAP is designed to capture radio images of the sky in more detail and faster than ever before. It will allow astronomers to answer fundamental questions about our universe, such as the nature of cosmic magnetism and the evolution and formation of galaxies.

ASKAP is located at the CSIRO-run Murchison Radio-astronomy Observatory in the Mid West region of WA, inland from Geraldton. The observatory is remarkably 'quiet' – it is relatively free of human-generated radio signals that would otherwise interfere with weak radio waves from space.

# Dementia diagnosis doesn't rule out air travel - QUT and Brisbane Airport lead the way

Teaming up with QUT has led to Brisbane Airport being named Australia's first dementia-friendly airport by Alzheimer's Australia.

Around 47 million people worldwide live with dementia, including more than 413,000 Australians, but many still travel. Until now, there has been little guidance for meeting the needs of such passengers for airlines, airports or carers. Previous studies reveal the most challenging part of air travel for people with dementia is managing the airport experience.

The QUT-based Dementia Centre for Research Collaboration (DCRC) has been working with Brisbane Airport since 2015. The result of their partnership is: *Ensuring a Smooth Journey: A Guide to Brisbane Airport for people living with Dementia and their Travel Companions*.

The step-by-step guide was prepared in collaboration with dementia advocates. Brisbane Airport Corporation now has a dementia-friendly action plan and a resources kit prepared by the DCRC.

The guide to the airport is available online at the Dementia Centre for Research Collaboration.

**<http://dementiakt.com.au/resource/airport-user-guide/>**

## HyLogger takes on world markets

An Australian technology that rapidly and cost-effectively provides new knowledge on orebodies and associated alteration could soon benefit the global mining industry, thanks to a commercialisation deal that will open doors to international markets.

CSIRO's advanced mineral analysis and logging technology – HyLogger – has been licensed to Australian METS company Corescan, which operates a network of hyperspectral mineralogy laboratories across Australia, South-East Asia, Canada, the US, Mexico, Peru, Chile and Argentina.

HyLogger uses the spectra of reflected light from mineral surfaces to interpret the mineralogy of the material and is claimed to

PHOTO: DAMIEN SMITH PHOTOGRAPHY



*HyLogger in action.*

be far more reliable for systematic mineral identification than visual techniques used in most drilling programs. It also provides near-real-time analysis so that costs and delays associated with laboratory analysis are greatly reduced.

CSIRO Research Director Dr Rob Hough said commercialising the technology with Corescan opened the way for the industry to

take advantage of hyperspectral analysis of drill materials for exploration and mining and further reinforced Australia's place as a global leader in the provision of mineral exploration and mining technology.

The Australian exploration industry spends close to \$600 million a year drilling holes to locate economic mineral resources, so detailed knowledge of the mineralogy and alteration patterns associated with prospective mineral regions is crucial to guide exploration success and attract international investment into Australia.

*Operating on an automated scanning platform, HyLogger uses visible and infrared light to characterise selected minerals from drill cores, chips and pulps that are often difficult or impossible for human observers to interpret correctly. Reflected light from the samples is broken into hundreds of different wavelengths by several spectrometers, allowing the recognition of unique spectral signatures for each mineral.*

## CSIRO PUBLISHES METS ROADMAP

CSIRO has released a technology roadmap to underpin growth in Australia's \$90 billion mining equipment, technology and services (METS) sector, urging companies to take action to unlock five key opportunities.

The Mining Equipment, Technology and Services Roadmap highlights the vital role that the METS sector will play in the nation's innovation ecosystem in order to drive change to meet future global mining challenges and metal supplies.

It was developed in collaboration with the METS Ignited Industry Growth Centre, as well as government, industry and researchers.

The Roadmap identifies five key growth opportunities to support the continued success of the METS sector:

- data-driven mining decisions;
- social and environmental sustainability;
- exploration under cover;
- advanced extraction; and
- mining automation and robotics.

Underpinning the success of each of these opportunities is a raft of new technology developments, as well as critical changes to people, skills, culture, collaboration, processes and business models.

In addition to this Roadmap, CSIRO has collaborated with METS Ignited on the METS Sector Competitiveness Plan – a complementary piece of work that outlines the strategic foundations for success over the next decade.

"This roadmap is a great example of Strategy 2020's Customer First work, which aligns our science to Australia's needs," CSIRO Chief

Executive Dr Larry Marshall FTSE said.

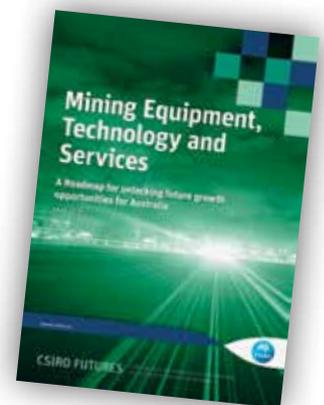
"In a sense we use science to anticipate the future and help us navigate to a better outcome.

"METS is an important Australian sector and a global leader, but it can't rely on past successes in a rapidly changing global landscape," Dr Marshall said.

"The sector must continue to innovate and take advantage of enabling technologies and new business models which are causing disruption across industries."

The Mining Equipment Technology and Services Roadmap is the third in a series of five Roadmaps being produced by CSIRO Futures, each aligned to the Federal Government's Industry Growth Centres. Earlier productions were the Advanced Manufacturing Roadmap and the Medical Technologies and Pharmaceuticals Roadmap.

*Two ATSE Fellows serve on the METS Ignited Board – Dr Peter Lilly FTSE and Dr David Skellern AO FTSE. Dr Lilly had 40 years' experience in the industry – half in universities and industrial research organisations and half in industry where he worked on mining and civil engineering projects in 15 countries. Dr Skellern is a successful ICT entrepreneur, with a strong background in research, education, collaboration, and commercialisation, and is Chairman of the Capital Markets CRC.*



# NEWS

The roadmap analysis.

## Low-emissions roadmap offers four energy paths

CSIRO's new Low Emissions Technology Roadmap outlines the technology options to meet emission reduction goals and steer Australia towards a secure energy future.

The roadmap analyses how changes in the electricity, industrial energy and transport sectors could help Australia meet or exceed its emissions reduction target for 2030 and contribute to further decarbonisation to 2050.

The roadmap also explores the potential economic opportunities that exist for Australian industry through deployment of relevant technologies or by participating in growing low-emission fuel and technology supply chains.

It takes a 'technology neutral' approach and presents four options or 'pathways' to decarbonisation of the energy sector, which currently accounts for 79 per cent of Australia's emissions.

Based on nine months' research, modelling and consultation, the report found that:

- Australia is endowed with energy-rich resources and is well positioned to benefit from innovation in low-emission technologies;
- energy productivity will remain important in reducing energy costs and emission levels throughout the transition;
- new energy generation is likely to be mainly in wind, solar PV,



storage and gas to meet our 2030 emissions reduction targets; and while the technology pathways are comparable in terms of cost, they carry different levels of commercial, technical, social and stakeholder risks.

"In the midst of disruptive change within the energy sector, we must address the 'energy trilemma' of security, affordability and sustainability," CSIRO Chief Executive Dr Larry Marshall FTSE said.

"CSIRO's Strategy 2020 is dedicated to using science to navigate Australia's industries, both traditional and emerging, into a brighter economic future enlightened by innovation," he said.

The Low Emissions Technology Roadmap was prepared for the Australian Department of the Environment and Energy to provide input to the Government's 2017 Climate Policy Review.

## \$20M FROM CEFC FOR LITHIUM MINE IN WA

The Clean Energy Finance Corporation (CEFC) is investing around \$20 million into a project producing lithium concentrate – an essential component in electric vehicles and battery storage.

Located about 120 km south of Port Hedland in Western Australia, the Pilgangoora open-pit lithium mine will produce lithium concentrate that can support a full range of lithium products used in products such as lithium batteries.

Lithium is a vital component in battery storage. Increasing the supply of lithium will help to drive the uptake of clean-energy technologies, such as electric cars and battery storage.

This is the Government's first investment in a mining project of its kind in Western Australia.

Construction of the mine is expected to commence in early 2018.

## BREAKTHROUGH IN GAS STORAGE

An international team of scientists and engineers has discovered a solution to a long-standing scientific problem of storing gases in common minerals. It could form the basis for a cheap and efficient way to power the hydrogen-fuelled vehicles of the future.

The study was led by researchers from The Fluid Science and Resources Group and The Australian Centre for LNG Futures at the University of Western Australia.

For more than 50 years, scientists have known that at lower temperatures the ability of many materials to adsorb and store gas molecules suddenly switches off. However, until now, there has been no clear explanation for this behaviour, and as a result no way to make use of it.

The team combined atomic-level calculations with challenging experiments covering a wide range of temperatures and pressures to develop an explanation for this phenomenon. It also demonstrated

how a particular porous material can have different temperatures at which it admits or releases certain gas molecules. In doing so, it established a new method of storing substantial quantities of energy-rich and clean-burning gases, such as hydrogen, at low pressures.

This means new sensing, separation and storage processes can now be designed for a range of gases using either cheap, naturally occurring minerals, known as zeolites, or a range of new designer materials known as 'metal-organic frameworks', developed for carbon capture and storage applications.

Dr Gang (Kevin) Li from UWA's School of Chemical Engineering said the capability to choose whether a certain gas can enter or leave a porous material by simply changing temperature opened up opportunities across a wide range of industries including energy storage, molecular sensing and isotope separations.

## Mapping our tidal energy resource

A three-year project will map Australia's tidal energy resource unprecedented detail in a \$5.85 million project titled 'Tidal Energy in Australia – Assessing Resource and Feasibility in Australia's Future Energy Mix'.

The study will be led by the Australian Maritime College at the University of Tasmania, in partnership with CSIRO, the University of Queensland and industry partners.

The project will create an online atlas mapping tidal energy nationwide to the nearest 500 metres. The project will also involve a full feasibility study of two high-potential sites, and modelling of existing tidal energy devices at these sites.

Tidal energy is generated by harnessing the movement of tides. Tides contain both potential energy, related to the vertical fluctuations in sea level, as well as kinetic energy, related to ocean currents. A modern tidal generator works much like an underwater wind turbine, harnessing the current created by the tide.

The Australian Renewable Energy Agency (ARENA) will contribute \$2.45 million, and four industry partners – OpenHydro, Protean Wave Energy, MAKO Tidal Turbines and BioPower Systems – will make financial contributions and provide the researchers with proprietary information on their tidal energy devices, as well as commercial implementation know-how.

Lead researcher Associate Professor Irene Penesis said this survey would overcome current barriers to investment in commercial-scale tidal farms in Australia.

"With some of the largest tides in the world, Australia is ideal for this extremely reliable and low carbon form of energy," Associate Professor Penesis said.

"But potential investors are currently held back by a lack of detailed information on tidal resources that would help them understand the risks and opportunities available."

## TESLA BACKS SA WITH BATTERIES

Tesla, the California-based car maker, energy storage company and solar panel manufacturer based in Palo Alto, California, has been awarded a contract by the South Australian Government to provide a 100 MW/129 MWh Powerpack system to be paired with global renewable energy provider Neoen's Hornsdale Wind Farm near Jamestown, 200 km north of Adelaide.

The Tesla Powerpack will be charged with renewable energy from the Hornsdale Wind Farm and then deliver electricity during peak hours to support SA's electrical infrastructure.

Tesla says the system will be completed by December and will be the largest lithium-ion battery storage project in the world, providing enough power for more than 30,000 homes.

## CALIFORNIA RENEWABLES CRACK RECORD

California's largest energy grid, controlled by the California Independent System Operator (CISO), achieved a record 67 per cent of its energy from renewable sources on 13 May – not including hydropower or rooftop solar arrays, online sources reported.

Adding hydropower facilities into the mix, the total was more than 80 per cent, drawn from sunny days with plenty of wind along with full reservoirs and growing numbers of solar facilities. CISO controls 80 per cent of California's power grid.

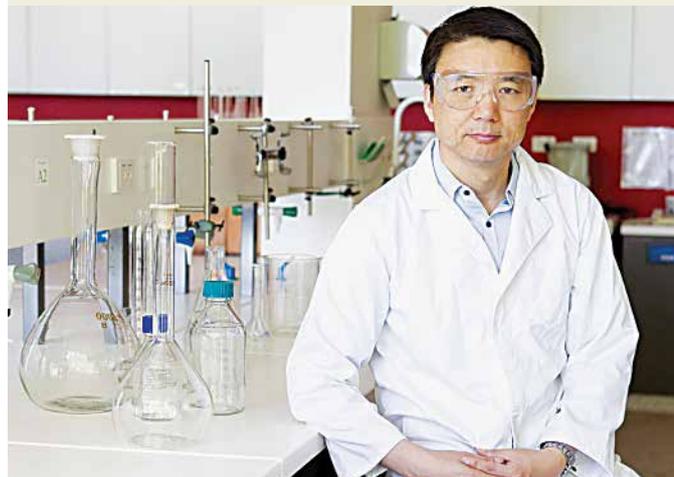
California also set a new wind power generation record on 16 May 2017, producing 4,985 megawatts.

## WATER SPLITTING COULD CUT HYDROGEN COSTS

UNSW chemists have invented a new, cheap catalyst for splitting water with an electrical current to efficiently produce clean hydrogen fuel.

The technology is based on the creation of ultrathin slices of porous metal-organic complex materials coated onto a foam electrode, which the researchers have unexpectedly shown is highly conductive of electricity and active for splitting water.

"Splitting water usually requires two different catalysts, but our catalyst can drive both of the reactions required to separate water into its two constituents, oxygen and hydrogen," says study leader UNSW Future Fellow Associate Professor Chuan Zhao.



Associate Professor Zhao

"Compared to other water-splitting electro-catalysts reported to date, our catalyst is also among the most efficient," he says.

Hydrogen is rated a very good carrier for renewable energy because it is abundant, generates zero emissions, and is much easier to store than other energy sources, like solar or wind energy. But the cost of producing it by using electricity to split water is high, because the most efficient catalysts developed so far are often made with precious metals, like platinum, ruthenium and iridium.

The catalysts developed at UNSW are made of abundant, non-precious metals such as nickel, iron and copper, part of the family of versatile porous materials called metal organic frameworks.

Until now, metal-organic frameworks were considered poor conductors and not very useful for electrochemical reactions. By creating nanometre-thick arrays of metal-organic frameworks, the UNSW team was able to expose the pores and increase the surface area for electrical contact with the water.

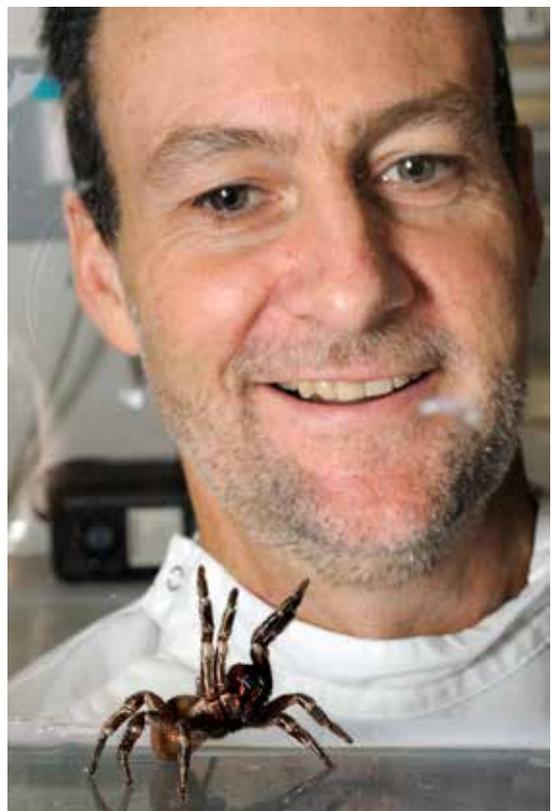
# Queensland is the place for health and medical innovation

The Queensland Government has a long history of investing in the life sciences sector including in world class enabling infrastructure, which is paying dividends. Most recently the government's \$420 million Advance Queensland initiative is helping position Queensland as a place where entrepreneurs, industry, universities and government collaborate to translate a greater number of discoveries into commercial healthcare products, treatments and businesses.

Advance Queensland provides a comprehensive suite of programs, including grants, designed to support the growth of innovation and business in Queensland. [advance.qld.gov.au](http://advance.qld.gov.au)

## Queensland Researchers discover spider venom treatment

Queensland research institutes are now providing innovative approaches to some of the world's most serious health problems. For example **Professor Glenn King (pictured)** and his team from the University of Queensland's Institute for Molecular Bioscience are investigating the potential of novel peptides developed from venoms of spiders, centipedes and scorpions to inhibit or activate the damaged ion channels common in pain, epilepsy and stroke. They are working closely with several pharmaceutical companies to develop drugs for clinical use.



## Upcoming events

LSQ  
*Gala*  
AND THE PESTLOFT WESSLEY  
ORDON

Contact Alix Goodwin for tickets  
07 3331 3939 / [agoodwin@lsq.com.au](mailto:agoodwin@lsq.com.au)



Life Sciences Queensland

Brisbane is hosting Australia's premier annual life sciences conference **AusBiotech 2018**



30 October – 2 November 2018  
Brisbane Convention and Exhibition Centre, Southbank

## Queensland Science Capability Directory

Discover more about the life sciences opportunities in Queensland with the online Queensland Science Capability Directory

[qld.gov.au/ScienceDirectory](http://qld.gov.au/ScienceDirectory)

## Screen-printed batteries for renewables

Ultra-thin, flexible, screen-printed batteries for cheap portable devices and intermittent renewable energy are coming closer to reality because of a joint University of NSW–UQ project to further develop technology by battery energy storage firm Printed Energy and bring it to market.

Printed Energy is a Brisbane company with patented technologies in printing batteries and photovoltaics and a laboratory in Arizona focused on energy storage and materials science.

The \$12 million project received a grant of \$2 million from the Cooperative Research Centres Projects scheme.

Printed Energy's solid-state batteries are a thin, flexible format – printed in a roll-to-roll process like a newspaper – that can be adapted to almost any shape. They have potential applications in powering everything from disposable medical devices, smart cards and wearable electronics to large-scale solar panels and energy storage.

"The highly innovative and unique nature of this technology makes it ideal for powering

sensors, devices for the Internet of Things, disposable healthcare devices and eventually, even for large-scale application to help manage the intermittent nature of electricity generated by solar panels," said Mr Rodger Whitby, CEO of Printed Energy.

Professor Mark Hoffman FTSE, UNSW's Dean of Engineering, agreed.

"Storage has been the missing piece of the puzzle when it comes to renewable energy. The world is crying out for storage solutions, and this partnership has the potential to deliver on that urgent need. What's exciting is that this technology also has immediate applications in wearables and small-scale devices."

Professor Chris Greig FTSE, Director of University of Queensland's Dow Centre for Sustainable Engineering Innovation and the UQ Energy Initiative, is also excited about the potential.

"Australia has seen a decline in manufacturing industries in recent decades.



Printed Energy laboratory.

This technology represents not just an opportunity for us to be involved in cutting-edge science and innovation, but presents a real opportunity for the next generation of Australian manufacturing.

"Our mission is to foster and facilitate advances in science and engineering which are technologically, economically and socially sustainable. This project fits the bill perfectly and the range of applications is probably only limited by our imaginations," he added.

First applications of the technology will be in small-scale devices, with development work in large-scale uses to be explored by the partners over the next three years.

## COTTON GROWERS MOST 'CONNECTED'

Cotton growers are the most 'connected' – in their use of digital technologies – and beef, sheep, grains and sugarcane growers are the least.

Meat and Livestock Australia digital strategy and business development manager Sam Gill told an Australian Farm Institute conference that intensive industries, like cotton, were more reliant on water and therefore had the highest usage of on-farm sensors.

Quoting CSIRO and University of New England statistics, he said 40 per cent of cotton growers were connected to mobile data and 47 per cent to radio data.

Horticulture producers were 30 per cent connected on both mobile and radio, and aquaculture and pork producers were 24 per cent connected to mobile and 22 per cent connected to radio.

The poultry sector had 17 per cent connectivity to mobile data and 20 per cent to radio.

Bringing up the rear was beef, sheep, grain and sugarcane with 10 to 20 per cent connectivity to mobile and less than 10 per cent connectivity to radio data.

## GOVERNMENTS LAUNCH DRIVERLESS VEHICLE GUIDELINES

The National Transport Commission (NTC) and Austroads have launched national guidelines for trials of automated vehicles, which support state and territory road agencies in providing exemptions or permits for trials, and give greater certainty to industry on conditions for trials.

The release of the guidelines is the first stage of the NTC's reform roadmap to support the deployment of automated vehicles. Ministers agreed to this roadmap in November 2016.

NTC Chief Executive Mr Paul Retter AM said the guidelines were designed to be flexible and easy for industry to use, to support trials across Australia.

Mr Nick Koukoulas, Chief Executive of Austroads, said the guidelines drew on international best practice and have a strong focus on safety.

Austroads is the grouping of Australasian road transport and traffic agencies, comprised of Federal, State and Territory government road agencies, the New Zealand Transport Agency as well as the Australian Local Government Association.

NTC provides advice to Government through the Transport and Infrastructure Council, which consists of Federal, State and Territory Ministers responsible for transport and infrastructure.

The guidelines are available on the NTC and Austroads websites.

# NEWS



James Linke and Johnson Xuesong Shen with the 3D mapping drone.

## LiDAR technology boosts UAV mapping

University of NSW Engineering researchers and Linke & Linke Surveys have partnered to develop the unmanned aerial vehicle (UAV) using spinning Light Detection and Ranging (LiDAR) technology, which delivers fast and accurate 3D maps of targeted areas and features.

Weighing about 12 kilograms, the small UAV can travel for up to 18 minutes above any terrain to deliver data from 30,000 reference points per second in real time.

One of its main potential surveying uses is in large construction projects, where substantial costs are derived from measuring stockpile volumes and waiting for accurate data.

Mr James Linke, director of Linke & Linke Surveys, said the UAV cut data-capturing times and costs dramatically.

Mr Linke said the UAV allowed surveying jobs to be done not only faster and cheaper, but also much more safely. "You can take a drone and fly it where you can't send a human surveyor, and easily bring it back," he said. "This is especially in situations like disaster relief, where there's a need for real-time data capture."

The UAV is still at the prototype stage, though the team can already see many applications beyond the construction industry. One is asset mapping – being able to assess with centimetre accuracy where specific features or items might be, such as an energy company auditing the position of its powerlines. Another is in the mining industry.

Research leader Dr Johnson Xuesong Shen, Lecturer from UNSW's School of Civil and Environmental Engineering, said the UAV could help the coal-mining industry keep its workers safe by mapping the risk of wall collapse.

## AUSTRALIA CAN BE A HIGH-QUALITY DELICATESSEN

Australia is well positioned to act as a delicatessen of high-quality products that meet the needs of millions of informed and discerning customers, both here and abroad, according to Dr Martin Cole, Deputy Director of CSIRO Agriculture and Food.

New technologies could see us eating algae-based sources of protein, developing allergen-free nuts and tolerable varieties of lactose and gluten, and reducing environmental impact through edible packaging.

"Australian businesses are among the most innovative in the world and, together with our world-class scientists, can deliver growth in the food and agribusiness sector amid unprecedented global change," Dr Cole said.

"Less predictable growing conditions, increasingly global value chains and customers who demand healthier, more convenient and traceable foods are driving businesses to new ways of operating."

He said CSIRO's new Food and Agribusiness Roadmap, charting a course for products, technology and innovation to secure future success in the sector, would set Australia on the path to sustainable growth in the sector.

Dr Cole said Australia exported more than \$40 billion worth of food and beverages each year, 63 per cent of which headed for Asia, and was a trusted supplier of sustainable, authentic, healthy, high-quality and consistent products.

The Roadmap was developed in collaboration with the Government-funded food and agribusiness growth centre Food Innovation Australia Ltd (FIAL).

Keeping a greater share of food processing onshore and better differentiating Australian food products are major themes across the Roadmap, which calls on businesses to act quickly or risk losing future revenue streams to the competitive global market.

Developed with widespread industry consultation and analysis, the Roadmap seeks to assist Australian food and agribusinesses with the desire to pursue growth and new markets.

The Roadmap outlines value-adding opportunities for Australian products in key growth areas, including health and wellbeing, premium convenience foods and sustainability-driven products that reduce waste or use fewer resources. It focuses on five key enablers: traceability and provenance; food safety and biosecurity; market intelligence and access; collaboration and knowledge sharing; and skills.



The Roadmap outlines value-adding opportunities for Australian products in key growth areas.



Blockchain: "We can't afford to be followers".

## Data61 probes blockchain

CSIRO's Data61 has delivered a comprehensive review of blockchain technology in two reports on the regulatory, technical and societal implications of using blockchain-based systems across various industries in Australia.

Adrian Turner, Chief Executive of Data61, Australia's data innovation group, said Australia

must be at the forefront of the technology.

"The pace of change we are experiencing as a nation is exponential and we can't afford to be followers in the adoption of emerging technology like Blockchain," Mr Turner said. "It has potential to reframe existing industries like financial services and seed new ones like food provenance and personalised health."

The first report, developed by Mr Rob

Hanson and Dr Stefan Hajkowicz in Data61's Strategic Insight Team, explores four plausible adoption scenarios of blockchain technology in Australia in 2030 including: aspirational, transformative, new equilibrium and collapse.

The second report takes a technical approach by exploring design alternatives for blockchain systems in three illustrative use cases: remittance payments, open data registries and agricultural supply chains.

The study highlighted that the path towards widespread adoption of blockchain-based systems is still not clear. Further research was required to create evidence that blockchain systems will work as intended and how they will operate with legacy systems.

In 2008, blockchain emerged as a technology to support digital currencies and it has quickly generated interest for its broad application across various domains such as health records, banking, voting, government services and provenance of data. A report by the World Economic Forum in 2016 found over \$1.4 billion was invested in blockchain technology in just three years.

Australia already has a number of world-recognised blockchain developments including the work of the Australian Securities Exchange, in collaboration with Digital Asset Holdings, to examine the use of this technology in its clearing and settlement system for the Australian equity market.

## ANSTO HELPS CUT VEHICLE POLLUTION

Research at the Australian Nuclear Science and Technology Organisation (ANSTO) headquarters aims to drive down global air pollution caused by cars and trucks.

An ANSTO team has been working with Japanese and Australian researchers on the development of a nanomaterial that can make more efficient catalytic converters, which are used in cars and trucks to convert the toxic exhaust gases into less toxic pollutants.

The research team developed a nanomaterial that is three to four times more efficient than conventional converters. The work was led by the National Institute of Materials Science and Waseda University in Tokyo and the University of Wollongong, and assisted by ANSTO.

The researchers used ANSTO's small angle neutron scattering instrument, Quokka, which essentially directs neutrons produced in the OPAL multi-purpose reactor to hit and scatter around material being researched. When the neutrons hit the material they scatter in a certain pattern to reveal the properties of the material at the atomic scale.

In this case, it helped identify the improvements in this new nanomaterial. The collaboration successfully synthesised highly porous rhodium nanoparticles and was published in *Nature Communications*.

The research could contribute directly to reducing a problem that ANSTO has been monitoring in areas of Australia and across the Asia-Pacific region for years: the source and movement of fine particle pollution.

Research from 2014 showed that exposure to fine particle pollution causes an estimated 520 deaths in Sydney alone every year.

ANSTO researchers use tools called positive ion accelerators and advanced data-collection techniques to accurately identify elemental air-pollution fingerprints, quantifying sources and origin. These methods are used in Australia and overseas to determine the sources of fine particle pollution and impacts on health, visibility and long-range transport of pollutants.

# NEWS

## Twenty-four innovative businesses get \$11.2 million boost

Software for the blind, a website security program to protect against automated attacks and sustainable aquaculture techniques are among the initiatives of 24 innovative Australian businesses to receive a \$11.2 million 'kick-start' to commercialise products for Australian and international markets.

The Accelerating Commercialisation funding, provided by the Federal Government, will support commercialisation by metropolitan and regional businesses to prove the viability of their products, processes or services and prepare them for market.

Businesses are required to dollar-match the grant funding.

The 24 projects offered support include:

- software enabling blind and vision-impaired people to interact with websites and access web-based business and government services;
- pipe-fitting technology that does not require welding or swaging, reducing down time for businesses in the oil and gas, marine, food and agriculture industries;

- an effervescent medical food drink for medically supervised use to manage early memory loss and Alzheimer's dementia;
- a 3D cell tower visualisation and analysis service for the wireless telecommunications industry that reduces costs, improves safety and maximises tower use;
- a cloud-enabled, wirelessly charged customer location system for the hospitality sector that saves businesses time and money and improves customer experience;
- intelligent, adaptive software for controlling extra-long, heavy haul trains that optimises train performance, improves safety and minimises costs;
- a website security program that protects against automated attacks and offers greater cost effectiveness, higher security and simpler implementation for businesses;
- an organic waste-management solution that produces cost-competitive biological fertiliser for agricultural markets; and
- sustainable aquaculture techniques that allow fish farming with a smaller footprint and better filtration.

### WASP GIVES DIGGERS A BATTLEFIELD EDGE

**A** new world-class surveillance and reconnaissance capability will give Australian soldiers an edge on the front line as a result of a \$101 million investment in Small Unmanned Aerial Systems.

Defence Minister Marise Payne said the systems were small enough to be carried, assembled and used by one person, and allowed soldiers to "see over the hill, around the corner and down the road".

Minister Payne said the capability would be acquired in two tranches; with the WASP AE chosen as the preferred option for the first tranche to meet an immediate need.

Defence Industry Minister Christopher Pyne said the WASP AE would be modified with Australian content.

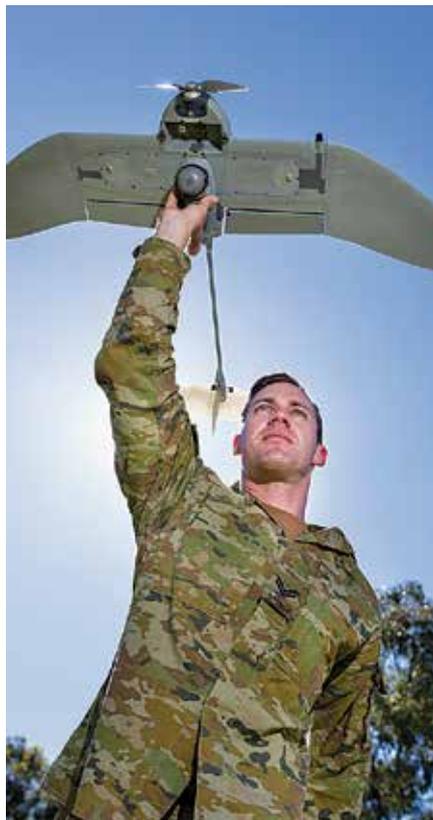
"Importantly, a significant proportion of this investment will remain in Australia, with local industry content valued at approximately \$11 million for acquisition, plus up to \$4 million each year for sustainment."

The second tranche will upgrade the WASP AE or acquire a replacement system within the next decade.

"This will also provide opportunities for

Australian industry," Minister Pyne said.

"Defence will work closely with Australian industry through the Centre for Defence Industry Capability to maximise opportunities for local companies to get involved in this important project," he said.



### THREE DEFENCE JOBS AWARDED

**T**hree Australian companies have won Defence Innovation Hub contracts worth nearly \$900,000, which Defence Minister Christopher Pyne says will help Australian industry to mature and further develop defence technologies that will create jobs and drive economic growth.

A \$618,000 contract signed with Newcastle-based firm Armor Composite Engineering will provide a low-profile body-armour system, which could be used by personnel in close protection roles.

Melbourne-based SYPAQ Systems has signed a \$172,000 contract with Defence to provide a small, lightweight, next-generation power generator tailored to land environments, which can be used by individual soldiers and vehicle-based forces.

A \$97,000 contract between Defence and Sydney-based Berkeley Information Technology will provide a software solution to support the protection of documents used on Defence information and communication systems.

*Corporal Doug Coombs prepares to launch a WASP AE.*



An artist's impression of the transportable air support facilities or cabins.

## Australian-made protection for aircraft operations

Defence has signed a \$37.5 million contract with Lockheed Martin Australia to provide portable facilities that will house top secret systems and support Air Force operations deployed overseas, primarily for the new F-35 Joint Strike Fighters.

Lockheed is working with Hunter Valley-based defence industry company, the Varley Group, to deliver the equipment, which will support F-35 missions by housing a portable Autonomic Logistics Information System (ALIS) or enabling connection to ALIS elsewhere in the world.

ALIS provides the off-board information system hardware, software and data for maintenance management, fault diagnostics, supply support, mission planning and training management across the F-35 weapons system.

The portable cabins will also hold the off-board mission planning system that would be used across the F-35A, F/A-18F Super Hornet, E/A-18 Growler and P-8 Poseidon.

"Acquiring these new portable, Australian-made cabins is an important part of our Joint Strike Fighter program and will mean that our top secret systems and personnel who support our jets on the ground will be securely housed and protected," Defence Industry Minister Christopher Pyne said, adding that the contract would create an additional 35 jobs in Newcastle and Adelaide.

"Australian industry is benefiting greatly from participation as a key strategic partner in the F-35 Program," he said. "More than 50 Australian companies have directly shared in more than \$800 million in production contracts to date, with hundreds more Australian companies indirectly benefiting through supply-chain work."

### \$70M TO MAINTAIN GLOBEMASTERS

The Government has extended existing arrangements by signing a \$70 million contract with Boeing Defence Australia to sustain Australia's fleet of C-17A Globemaster aircraft, the core of the RAAF heavy lift capability. Australia took delivery of the first C-17A in 2006 and now has a fleet of eight.

### ANSTO CHECKS THE FEATHERS

ANSTO research into feathers may provide important new insights about the evolution and health of birds.

ANSTO has been using advanced X-ray imaging on long-distance migratory seabird feathers, which can indicate the health of individual birds, and also of the environment they rely on, to get insights into their overall health and their evolution.

The study produced novel images that demonstrate the complex chemical distribution in bird feathers, which promises to lead to a better understanding of the physiological processes behind feather growth.

The images showed a regular pattern of bands, similar to tree rings, with roughly the same number of rings as days in a month of feather growth.

The advanced imaging techniques at the Australian Synchrotron's X-Ray Fluorescence Microprobe enabled the team to detail the previously undocumented patterns and properties of the feather.

The feathers came from three species of migratory shearwaters, birds that are known to travel over 60,000 kilometres per year on their migration to breeding areas.

Single breast and wing feathers from the fleshfooted, streaked and short-tailed shearwater were collected on Lord Howe Island, several Japanese islands and Bundeena Beach (NSW).



Taking a new look at feathers.

The images showed a regular pattern of bands, similar to tree rings, with roughly the same number of rings as days in a month of feather growth.

### \$2.3 BILLION LOG HARVEST

Australia's forest industry achieved a record plantation log harvest of more than 30 million cubic metres, worth over \$2.3 billion in 2015-16 according to a report released by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

The report showed that both the volume and value of logs harvested in 2015-16 had outstripped previous years, reflecting the growing demand for Australian timber in both domestic and international markets.

# NEWS



Researchers from CSIRO's Data61 have developed new technology that uses the way a person walks – their gait – to power wearable devices and could possibly be used as a new authentication method to replace passwords, pins or fingerprints.

Rather than looking at an individual's unique movements as a form of authentication, researchers at CSIRO's Data61 have developed a prototype wearable device to capture how an individual's unique energy generation pattern can be used as a form of authentication.

Small sensors called accelerometers can currently be used to capture an individual's gait in terms of motion and velocity. However, this reduces the battery life of wearable devices and has prevented gait authentication from becoming more widely adopted.

Researchers from CSIRO's Data61 have overcome this by

combining gait recognition with a technique called kinetic energy harvesting (KEH), which translates a person's motion into electrical energy and improves battery life.

To test how secure KEH gait authentication is, the researchers conducted a trial on 20 users. Data was collected from each user using two different settings from various environments. Users walked in several environments including indoor on carpet and outdoor on grass and asphalt terrains to capture the natural gait changes over time and surfaces. They say the trial showed that KEH-Gait can achieve an authentication accuracy of 95 per cent and reduce energy consumption by 78 per cent, compared to conventional accelerometer-based authentication techniques.

The KEH-Gait system was also tested against 'attackers' who attempted to imitate an individual's motions. The analysis found only 13 out of 100 imposter trials were wrongfully accepted by the system as genuine trials.

Wearable technology presents an opportunity to explore new authentication methods based on our movements. The wearable devices market is booming. According to a recent report, about 55 per cent of Australians own one and the global market for personable wearable devices is expected to reach US\$150 billion by 2026.

Alongside KEH-Gait sampling, Data61 is exploring other more secure and implicit continuous authentication techniques such as unique breathing patterns and distinctive behavioural biometrics from the way users innately interact with their devices.

## NINE FOCUS AREAS FOR RESEARCH INFRASTRUCTURE

The Australian Government has released the 2016 National Research Infrastructure Roadmap, which outlines research infrastructure priorities for Australian research excellence. It names nine focus areas for infrastructure investment:

1. Digital data and e-research platforms
2. Platforms for humanities arts and social sciences
3. Characterisation (techniques for understanding the properties of materials)
4. Advanced fabrication and manufacturing
5. Advanced physics and astronomy
6. Earth and environmental systems
7. Biosecurity
8. Complex biology
9. Therapeutic development.

It was developed by Australia's Chief Scientist, Dr Alan Finkel AO FAA FTSE, and an expert working group, which

undertook a thorough analysis of Australia's research infrastructure priorities.

The Roadmap attracted considerable stakeholder interest, with more than 320 submissions commenting on the expert working group's capability issues paper and more than 170 comments on the draft roadmap.

The Expert Working Group also directly consulted more than 580 stakeholders and made 51 site visits.

The EWG included three ATSE Fellows – Professor Edwina Cornish AO FTSE, Dr Andrew Cuthbertson FTSE and Dr Adi Paterson FTSE.

It was supported by six teams of eminent researchers that assisted in identifying Australian research infrastructure capability by assessing what we have and what the nation might need in the future.

This group also included a number of Fellows – working in six teams – former ATSE President Professor Peter Gray AO FTSE (Health and Medical Science), Dr Cathy Foley PSM FTSE (Advanced Physics,

Mathematics and Materials), Dr Joanne Daly FTSE (Environment and Natural Resource Management), Dr Jackie Craig FTSE and Mr John Gunn FTSE (National Interest and National Security) and Professor Robyn Owens FTSE (Underpinning Research Infrastructure).

The Academy supports the nine infrastructure capability focus areas, but suggests that two additional areas be considered.

First, there is an urgent, ongoing and likely expanding need to better understand the construction and operation of civil infrastructure in Australia, including transport, energy, water and communications infrastructure.

Second, the Australian innovation sector needs to support large-scale demonstration and validation of novel industry-ready technologies, particularly relating to engineering science.

ATSE noted that many of recommendations and suggestions from its initial submission to the Issues Paper had been adopted.

## Waste plastic to plumbing parts

Researchers and students from Deakin University's School of Engineering are working on world-first technology to turn waste plastic into filaments suitable for use in solar-powered 3D printers to print fully engineered plumbing parts such as pipe connectors.

Team leader Dr Mazher Mohammed, a research fellow at the School of Engineering, and his students tested the idea using the waste plastic around their offices, from cast-off 3D prints to milk bottles from the tearoom. They have also experimented with blends of different types of plastics and 3D prints made from 100-per-cent-recycled material.

The fact that the plastic can be repeatedly recycled opened up the possibility of simply grinding down broken parts, including components of the printer itself, to make new ones, he said.



The Deakin team (from left): Tony Watson, Anirudra Das, Dr Mazher Mohammed, Dr Clara Usma Alvarez, Nathan Low and Lachlan Patrick.

The equipment for turning waste plastic into filaments and the solar powered 3D printers will be trialled in the Solomon Islands by children's charity Plan International Australia later this year.

"3D printing has already been applied in various aid and disaster-based scenarios to make simple medical and water augmenting devices," Dr Mohammed said.

"However, the unique feature of our project is that we're using renewable energy to power equipment that recycles plastic rubbish

to make parts that people in these communities need to maintain their water supply.

Plan Australia's Manager for Water, Sanitation and Hygiene, Tom Rankin, said the potential applications of the technology were "limitless".

"This technology really lends itself to developing countries, where plastic waste has exceeded the capacity of governments to manage it. If we can prove the concept and get the technology working well, it can be used across a raft of different fields, not just water and sanitation."

## MATHS APP HELPS WITH FRACTIONS

A new maths game developed in WA has improved Perth primary school students' knowledge of fractions by more than 10 per cent over their classmates, according to new research.

The Abydos app was developed by Edith Cowan University (ECU) and St Stephen's School and uses the theme of ancient Egypt to teach students about fractions.

In research published in the *Journal of Computer Assisted Learning*, results showed a group of Year 6 students who used the app scored 10.5 per cent higher than those who didn't after just two sessions a week for four weeks using the app.

ECU Computer Science lecturer Dr Martin Masek said the app responded and adapted to players' abilities to ensure they are always learning. "For example if a student gives three incorrect answers to a problem, the app will modify the next problem to a lower level and vice versa. This adaptation ensures students don't disengage from learning if the game is too hard or too easy."

## CRC FOCUS ON TRUSTED AUTONOMOUS SYSTEMS

The Government has announced funding of up to \$50 million (over seven years) for the CRC for Trusted Autonomous Systems – the first of the Defence Cooperative Research Centres aligned with its Next Generation Technologies Fund.

Defence Industry Minister Christopher Pyne said it would focus on Trusted Autonomous Systems to deliver game-changing unmanned platforms that ensure reliable and effective cooperation between people and machines during dynamic military operations.

The Defence CRC is a collaborative program that brings together academia, publicly funded research agencies, industry (particularly small to medium enterprises) to create an interlocking research and innovation capability.

"Existing autonomous and robotic systems that operate in the manufacturing and mining sector are effective in controlled environments but not suitable for the uncertain situations in which Defence operates," Mr Pyne said.

"To be effective, Defence needs autonomous systems to be highly trusted, robust and resilient and this initiative will bring together the best researchers from industry and universities to develop the intelligent military platforms of the future."

The CRC is an initiative of the Next Generation Technologies Fund which complements the Defence Innovation Hub as the two core initiatives of the new Defence Innovation System outlined in the Government's Defence Industry Policy Statement – along with the Centre for Defence Industry Capability.

**The Defence CRC is a collaborative program that brings together academia, publicly funded research agencies, industry (particularly small to medium enterprises) to create an interlocking research and innovation capability.**

# NEWS

## Report tracks all 43 GHGs

Australian scientists have published what they describe as the most comprehensive and high-quality records of greenhouse gases (GHGs) ever collated.

Led by researchers from CSIRO's Climate Science Centre and The University of Melbourne, the records track the past and current changes in all 43 GHGs that contribute to human-induced climate change.

"This continuous record over the past 2000 years has been meticulously constructed by combining greenhouse gas measurements from dozens of laboratories around the world," said CSIRO Principal Research Scientist and report co-author Dr David Etheridge.

"We took data from contemporary and archived air samples, and from air trapped in ice bubbles in polar ice cores and compacted snow, also called firn."

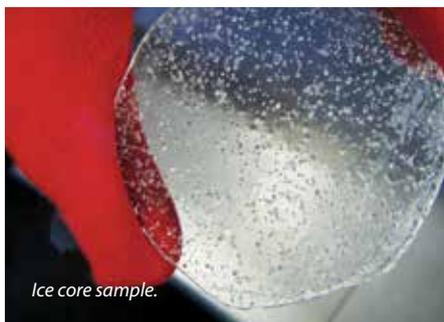
Dr Etheridge said that a comprehensive database of measurements was combined with information on aerosol, solar, volcanic and land-use impacts on climate to accurately simulate observed climate over past centuries in climate models.

Australia (through CSIRO and the Bureau of Meteorology) is the major contributor to this global GHG record, using observations from the BoM's Cape Grim station in north-west Tasmania and from the Cape Grim Air Archive. It is also the primary source of GHG data in the pre-instrumental era, using measurements from air extracted from Antarctic ice and firn.

Dr Malte Meinshausen, from The University of Melbourne's Australian-German Climate and Energy College and lead author of the report, said that this new database would drive global climate model simulations currently being conducted by international modelling groups ahead of the next Intergovernmental Panel on Climate Change (IPCC) assessment report, due in 2021-22.



The Cape Grim station.



Ice core sample.



Ocean pollution choking parts of Port Moresby.

### SURVEY TACKLES OCEANS OF POLLUTION

PHOTO: SUSTAINABLE COASTLINES

CSIRO is part of the world's largest marine pollution survey, working with countries across the globe to help assess and reduce the amount of litter entering the oceans.

Some of the world's top 20 polluters will take part in the project – including China, Bangladesh, Indonesia, Vietnam and the US – which launched with a workshop in Korea in June.

The project follows years of marine debris research led by CSIRO senior scientist Dr Denise Hardesty and her team, which has published significant findings including quantifying the amount of litter on the entire Australian coastline and reporting on the number of seabirds and other wildlife eating plastic.

Dr Hardesty said the project would provide hard numbers on the amount of litter entering the ocean by using real data collected on coastlines and cities across the globe, rather than relying on estimates from World Bank data.

### SCIENCE TACKLES ILLEGAL FISHING

Science is joining the fight against illegal fishing, the third most lucrative crime in the world after weapons trafficking and drug smuggling, with CSIRO developing a world-first notification system that alerts authorities when offending vessels arrive in port.

The web-based reporting tool identifies and ranks fishing vessels across the globe based on a list of behaviours associated with illegal, unregulated and unreported (IUU) fishing.

CSIRO senior scientist and co-designer of the platform Dr Chris Wilcox said the tool used data collected by satellites to monitor and report suspiciously behaving vessels.

"Almost all vessels are equipped with anti-collision devices that can be detected by satellites," Dr Wilcox said.

"Using data from these systems, we can shine a spotlight on vessels acting suspiciously based on factors including the vessel's history, movement and whether its transmitter has been intentionally disabled."

The announcement follows the execution of the first international treaty aimed at eradicating IUU fishing, coordinated by the United Nations Food and Agriculture Organization and agreed to by 29 countries.



*The Centre for Southern Hemisphere Oceans Research (CSHOR) will research ice movements.*

play a crucial role in the climate system, absorbing more heat and carbon dioxide than any other region in the world," Dr Marshall said.

"Improving our understanding of the complex science at play in this system, will help us better manage the impacts of climate variability and change at a regional and global scale.

"CSHOR will complement climate research within CSIRO and will sit within our recently announced Climate Science Centre."

With funding of \$20 million over five years, CSHOR will be based at CSIRO's Marine Laboratories in Hobart and will support seven new research positions, primarily based in Hobart. CSHOR research will include the impact that melting Antarctic ice shelves will have on global sea level rise and will also investigate climate phenomena like the El Niño–Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD), which have a strong influence on the climate of both Australia and China.

## CSIRO puts new focus on Southern Ocean

CSIRO is collaborating with China's Qingdao National Laboratory for Marine Science and Technology (QNLN), with support from the University of Tasmania and the University of New South Wales, to establish a new research centre in Hobart, focused on the role of the Southern Hemisphere oceans in the global climate.

CSIRO Chief Executive Dr Larry Marshall FTSE said the Centre for Southern Hemisphere Oceans Research (CSHOR) would study the oceans from the tropics to Antarctica, and would tackle fundamental questions about the future climate of Australia, China and the rest of the world.

"The oceans in the Southern Hemisphere

### \$25 MILLION FOR COLLABORATION WITH US UNIVERSITIES

The Government will invest \$25 million aimed at getting Australian universities to collaborate with some of the top universities in the US.

"Defence will invest up to \$25 million over nine years for Australian universities to leverage the existing US Multidisciplinary University Initiative (MURI) grant program, which is administered by the US Department of Defense," said Defence Industry Minister Christopher Pyne.

The Australian program, called AUSMURI, will provide grants to support multidisciplinary teams of Australian university researchers who collaborate with US academic colleagues on high-priority projects for future Defence capabilities.

The funding is being provided under the Next Generation Technologies Fund. Eligible universities that are successful in a collaborative US MURI submission will receive an AUSMURI grant of up to \$1 million a year for three years to support their research in Australia.

At the end of three years, the AUSMURI grant may be extended for a further two years based on performance and prospects, with an additional budget of up to \$1 million per year.

Until recently, Australian universities could collaborate on US MURI projects but were not eligible for grant funds.

### PAUL HARDISTY HEADS AIMS

Environmental engineer Dr Paul Hardisty has taken over as CEO of the Australian Institute of Marine Science (AIMS) from outgoing CEO Mr John Gunn FTSE, a highly regarded leader within the scientific community.

Dr Hardisty has more than 30 years' experience in the environmental and sustainability fields, with global expertise in the resources and industrial sectors, as well as advising corporations and governments regarding environmental economics and strategy.

He was the Director, CSIRO Land and Water Flagship (July 2014 to March 2017), where he led a team of more than 1000 research scientists, engineers and economists, delivering research and development in the fields of terrestrial and water management, pollution, social and economic sciences, cities, earth observation, and climate adaptation.

Previously Dr Hardisty was Director of CSIRO's Climate Adaptation Flagship, which researched options to address climate change and variability.

*Paul Hardisty*



# NEWS

## Student cracks UAV issues

A 19-year-old law student from The University of Western Australia has invented an unmanned aerial vehicle (UAV) that is claimed to be capable of flying five times longer than many drones currently on the market and conducting aerial surveillance at a fraction of the cost of current manned aircraft.

Tom Maclaurin, from the Perth suburb of City Beach, said his schoolboy hobby building remote-control aeroplanes developed into a bigger passion.

"The device, named 'Swift', is capable of flying for more than six hours before its battery runs out and can be used to monitor anything on the ground by picking up data

from sensors, taking images or recording video," Mr Maclaurin said.

Mr Maclaurin said the invention addressed the cost and time issues around aerial surveillance.

"What I have created is not only far cheaper, but can be operated remotely and is easy to use. It is lightweight and can glide safely to a stop should it lose power, instead of current drones, which drop out of the sky when their battery runs out."

Mr Maclaurin said his two-metre, six-kilogram device could have many useful applications: beach patrols or

monitoring land, crop levels, dam levels or cattle locations.

Mr Maclaurin recently won the Student Start-up of the Year Award at UWA's IQ Awards for his invention and is looking for investors and industry collaborators from local government, the agriculture industry and Surf Life Saving.



Tom Maclaurin with his 'Swift'.

## STEM REPORT BACKS PD AND COLLABORATION

A key element in STEM education is the need for the professional development (PD) of teachers to enable successful school-industry collaboration, and the role of education systems in providing this support.

Schools and companies also need support to form sustainable and enduring partnerships to jointly advance student STEM skills.

These are key findings of the Australian Industry Group's new report *Strengthening School-Industry STEM Skills Partnerships*.

This report follows a two-year research project funded by the Office of the Chief Scientist to improve student participation in STEM-related disciplines by encouraging school and industry collaboration.

The report also investigated the need to improve teacher and student understanding of the demand for STEM skills in the workplace, and to encourage students to consider further study and a career in STEM.

Australia's Chief Scientist Dr Alan Finkel AO FAA FTSE said the report provided a strong foundation to support future school and industry collaboration.

"We need to provide our teachers with the best possible support and professional development, so they in turn are well positioned to inspire students. This project does an impressive job identifying models of schools and industry working together that we can learn from and scale up," Dr Finkel said.

The report found that multiple models of school-industry engagement were already in place across Australia, ranging from 'single school-single company' models, through to larger hub-type arrangements involving many partners.

The project included an extensive national mapping exercise, which resulted in the production of the STEM Programme Index 2016.

## STEM FORUM TACKLES CAREER ISSUES

The STEM Partnerships Forum, established by the COAG Education Council, will explore ways for industry partnerships to help equip teachers, career advisers and parents to advise students about emerging career opportunities and the specific skills and knowledge required.

Its initial meeting in Canberra said that industry had a significant role to play in dispelling the incorrect expectation that STEM graduates should only work in traditionally recognised STEM careers.

It noted that in today's fast-changing world, driven by technological change, the strategic skill sets inherent in STEM subjects were in high demand and it recognised the need for a highly skilled workforce to power the future competitiveness and prosperity of the nation and strong community understanding of the critical role that STEM skills play in a knowledge-based economy.

Under the chairmanship of Australia's Chief Scientist Dr Alan Finkel AO FAA FTSE, the Forum includes representatives from some of Australia's largest companies, such as Boeing Australia, BHP Billiton, Commonwealth Bank, CSL Ltd and Google Australia, as well as senior representatives from across the education sector.

The STEM Partnerships Forum is a collaborative action under the National STEM School Education Strategy 2016-2026, endorsed by all Australian education ministers in December 2015. The Forum will initially run for two years.

The purpose of the first meeting was to lay the groundwork for a more strategic approach to school-based STEM partnerships with industry, to build the workforce of the future and assure the continued competitiveness and prosperity of Australia.

## Cookie Cutter shark and a Shortarse Feelerfish

A Cookie Cutter shark, a herd of Sea Pigs and the outlandishly named Shortarse Feelerfish were among a bizarre cargo of deep-sea creatures collected by an international team of scientist on a month-long journey through Australia's marine Abyss off the east coast.

The Abyss is a deep, dark, crushing environment 4000 metres below the sea's surface and is considered one of the most inaccessible and unexplored environments on the planet.

More than one-third of the spineless critters and some of the fishes found during the 'Sampling the Abyss' voyage are completely new to science.

The 31-day expedition, led by Museums

Victoria and supported by the CSIRO Marine National Facility and the NESP (National Environmental Science Program) Marine Biodiversity Hub, saw a team of 58 scientists, technicians and crew, from 14 institutions within Australia and around the world, travel from Launceston to Brisbane on board the Marine National Facility research vessel *RV Investigator*.

"Australia's deep-sea environment is larger in size than the mainland and, until now, almost nothing was known about life on the abyssal plain," said Dr Tim O'Hara, the voyage's Chief Scientist and Museums Victoria's Senior Curator of Marine Invertebrates.

The voyage also investigated pollution found on the sea floor and other human impacts, such as microplastics in surface waters.

"We have found highly concerning levels of rubbish on the seafloor. We're 100 kilometres off Australia's coast, and have found PVC pipes, cans of paints, bottles, beer cans, woodchips and other debris from the days when steamships plied our waters," Dr O'Hara said.

One of the key outcomes of the voyage will be maps of seafloor life, created using sonar coupled with underwater camera vision, which have revealed a diverse seascape of rocky plains, huge canyons and

*Cookie Cutter sharks have fierce teeth.*



PHOTO: MATTHEW NEWTON

Tim O'Hara and the *RV Investigator*.

undersea mountains.

Large areas of the recently created Commonwealth Marine Reserves were mapped for the first time.

The Abyss is defined as more than 3.5 km deep, but in some parts of the ocean it gets as deep as 11 km. There are about 8 million km<sup>2</sup> of deep sea in Australian oceans, more area than the country's dry land.

"We know exactly what occurs at those depths in some other places like the North Atlantic, and around Japan, and perhaps some other areas as well," Dr O'Hara said.

But it was an environment that had not really been investigated in the Southern Hemisphere before this voyage.



PHOTO: ROB ZUGARO

## FIVE IN TOP 500 RESEARCH UNIS

Australia has 16 of the world's top 500 research-intensive institutions, according to the The CWTS Leiden Ranking 2017.

Leading the pack was the University of Sydney, ranked at 29, followed by the University of Melbourne (31), University of Queensland (35), Monash (64) and University of NSW (68).

The next bracket included the University of WA (153), Adelaide (182) and the Australian National University (191).

Five universities were ranked in the 300s – Griffith (351), Curtin (355), QUT (364), Newcastle (371) and Deakin (383) – and three in the 400s – Wollongong (405), Macquarie (423) and UniSA (478).

Tasmania (507) led the next group, followed by UTS (510), RMIT (520), Flinders (524), James Cook (536) and La Trobe (588). The Australian contingent was rounded out by UWS (612), Swinburne (772) and Murdoch (900).

CWTS Leiden ranked Harvard first, followed by the University of Toronto, Zhejiang University (China), the University of Michigan (US) and Shanghai Jai Tong University (China). Its top 10 was rounded out by Johns Hopkins (US) Sao Paulo (Brazil), Stanford (US), Seoul National and Tokyo.

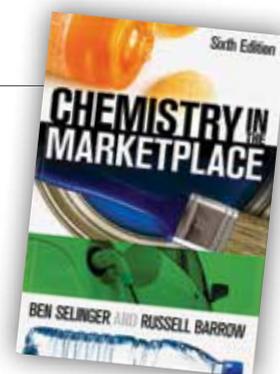
The CWTS Leiden Ranking 2017 offers key insights into the scientific performance of 902 major universities worldwide. A sophisticated set of bibliometric indicators provides statistics on the scientific impact of universities and on universities' involvement in scientific collaboration.

It is compiled by Leiden University (ranked 122), which was founded in 1575 and is one of Europe's leading international research universities, with more than 6500 staff members and 26,900 students, spread over locations in Leiden and The Hague, in the Netherlands.



BY IAN RAE  
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# Immerse yourself in 40 years of chemistry



*Chemistry in the Marketplace* by Ben Selinger and Russell Barrow, 6th edition. CSIRO Publishing, 2017 xvi + 535 pp.

It's rare book that makes it to the sixth edition. This one is indeed a rare species: there is nothing quite like it. To quote Ben Selinger – well-known to many Fellows – who started all this in 1973, it is “not a textbook, and follows no chemistry syllabus; rather it is a reference for students, teachers and the general reader”.

Russell Barrow, joining Selinger to produce this edition, is a natural product chemist who grew up with the book. He points out that the book is not meant to replace the internet but, in fact, refers constantly to places (beginning with “http” or “https”) where more information can be found.

I remember Ben complaining, as he compiled the first editions, of the difficulty in getting information about just what chemicals are in those consumer products. By now, he observes, “both industry and government have become more open and user-friendly”.

Still, there are gaps. I was interested to learn that the well-known glue, ‘Tarzan’s Grip’ is an Australian invention, but its composition is not disclosed except that it is “solvent-based”. I’d put my money on polystyrene but, bereft of a laboratory, I’ll have to wait in hope that the answer will appear in the 7th edition.

Trawling through ‘CiM6’, as they like to call it, and referring to its predecessors, I found lots of changes but the basic structure of the book remained unchanged.

Some changes are merely those of emphasis, such as the decrease in the coverage of arsenic, although the Bogong moths appear for the first time in this latest edition. There is increased coverage, however, of energy and radiation, linked to themes in alternative energy and nuclear technology, respectively.

Some issues that one sees debated in current media are explored briefly, for example obesity (linked to diet but 70 per cent determined by genetics), longevity (choose a high-carb, low-protein diet) and

fertility (choose the opposite if you don’t wish to extend your child-bearing years).

The new edition has an expanded and more nuanced explanation of why the unpleasant odour of sulfur compounds can be detected in the urine of some people after they have dined on asparagus. There is a great index and browsing in it leads to some surprises, mostly positive but on the negative side there was nothing about nanoparticles.

And of course there are experiments to help the reader “navigate the murky world of chemicals”, to quote the flyer for book’s recent launch.

One that has done the rounds of not-quite-politically-correct chemistry for years is Bill Mansfield’s sinking goose experiment, a demonstration of surface active properties. You don’t need a goose – it works just as well with a spider, and (ever the experimentalist) I have found that there is enough surface-active material in urine to sink the spider if the experiment is conducted in a toilet bowl.

There are implicit tests like this dotted through the text – another one is about the angle of repose of ground coffee – and others are addressed explicitly in the final chapter. One of them carries the warning that it’s not for home consumption but should only be done in a laboratory under professional supervision.

The chemistry in CiM6 is presented at a number of levels, so one can find trivial examples juxtaposed with quite complicated material, but one of the more abstruse sections, on phase diagrams, gets a whole appendix to itself. There is an appendix on logarithmic scales, too, and it shades into a discussion of perceived and actual risk.

Sometimes the effort to produce a simple, straightforward explanation can fail to mention an important detail. For example, the production of iron from iron oxide is represented by the equation

$\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO}$ , which is fine as a kind of bookkeeping statement but hides the fact that the carbon is first converted to carbon monoxide (CO) and it’s this gas that achieves the reduction of the iron oxide. Carbon monoxide is a major component of the atmosphere inside a blast furnace, and I have seen that warnings about its toxicity are shown prominently on the platform at the top.

In another example, I’m not too sure about the reason advanced for the fact that a mixture of salt and vinegar cleans the tarnish (copper oxide) from a copper surface, leaving the bright metal exposed. I always understood that the stabilisation of the resulting copper ions, in this case by complexing with chloride, was responsible for driving the thermodynamics of the change. Vegemite, in which the amino acids perform the complexing role, produces the same change and it’s easily demonstrated on a copper coin ... if you still have one.

Selinger quips that the successive issues of *Chemistry in the Marketplace* “provide a nice social history of how the issues in the marketplace have changed over 40 years”.

“Don’t throw them out”, he urges, and that’s fine for long-term fans like me who have a number of editions on the bookshelf. If you have never owned one of these books before, or bought one for your children and grandchildren, and you would like to see what it’s all about, go to [www.amazon.com](http://www.amazon.com), search under ‘Selinger’ for this sixth edition and then click on ‘look inside’ where you can inspect about 20 per cent of the book.

Then it will be time to take the plunge. It’s certainly a book to become immersed in. ☺

*Professor Ian Rae FTSE, an Honorary Professional Fellow at the University of Melbourne, is a former technical Director of ATSE. He was President of the Royal Australian Chemical Institute (2006–08) and served for a decade as a technical adviser to the UN Environment Programme. He is co-editor of the AAS journal Historical Records of Australian Science.*

# ATSE PEOPLE

## Two Fellows win ARC Laureate awards

Two Fellows have been named 2017 Australian Research Council Laureate Fellows: Professor Svetha Venkatesh FTSE, from Deakin University, and Professor Zhiguo Yuan FTSE, from the University of Queensland.



Zhiguo Yuan



Svetha Venkatesh

Professor Venkatesh was awarded \$3 million for a project to accelerate scientific innovation through pattern analysis.

Professor Venkatesh is Director of the Strategic Research Centre for Pattern Recognition and Data Analytics at Deakin. Her research interests lie in machine learning, probabilistic models, data mining, health analytics, multimedia and social media analysis.

Her research has led to frontier technologies in large-scale pattern recognition in big data and several start-up companies. Professor Venkatesh was elected a Fellow of the International Association of Pattern Recognition in 2004 for contributions to formulation and extraction of semantics in multimedia data.

Her project aims to determine how pattern recognition can be harnessed to accelerate and expand the capability of experimental optimisation that underpins scientific innovation. Disrupting current experimental methods, this new framework will use data-driven models to guide humans

through experimental complexity.

The expected outcomes of the project include advancing the theory and practice of pattern recognition, transforming the way complex experimental explorations can be done and establishing Australia as a leader in innovation-led productivity in the fourth industrial revolution.

Professor Yuan was awarded \$2.9 million for a project to convert methane into liquid chemicals.

Professor Yuan is a Professor within the UQ Faculty of Engineering, Architecture and Information Technology, where he is Director of the Advanced Water Management Centre. Professor Yuan is also Leader of the Future Technologies Program of the Cooperative Research Centre for Water Sensitive Cities.

Professor Yuan's research focuses on the development of innovative solutions for urban water management through effective integration of fundamental science and applied engineering. His research has delivered substantial savings to the Australian

water industry and his research achievements have been acknowledged through awards, such as the 2015 Clunies Ross Award and the International Water Association 2014 Global Project Innovation Award in Applied Research.

Professor Yuan was named as one of Engineer Australia's Top 100 Most Influential Engineers for 2015.

His project aims to develop a suite of leading-edge biotechnology solutions to enable the cost-effective production of liquid chemicals from biogas, creating a much stronger economic driver for biogas production from organic wastes, by significantly increasing the value of biogas compared to its current use for power generation.

The project aims to advance the fundamental science in anaerobic microbial conversion of methane, which is seen as having strong potential to create a new biotechnology sector producing high-value chemicals from methane and propel Australia to the forefront of sustainable resources research.



Tony Wong (third from right) and colleagues on Awards night.

### AWARD FOR TONY WONG'S CRC

The CRC for Water Sensitive Cities (CRCWSC), headed by Professor Tony Wong FTSE, was recently recognised with a 2017 Excellence in Innovation award, presented by the CRC Association at a ceremony in the Great Hall of Parliament House. The award recognised the CRCWSC's impact in supporting the Chinese City of Kunshan to become more 'water sensitive' – to the point where it is now China's

leading example of urban water innovation.

"Engagement with the CRCWSC has been an invaluable conduit of new science, technology and design concepts that have transformed the thinking of urban design and city development," said Mr Shi Jiangang, Chairman of the Kunshan City Construction, Investment and Development Company (KCID). In collaboration with the CRCWSC, Kunshan has successfully implemented more than 300 water-sensitive projects in three years through a partnership with the Kunshan City Bureau of Planning, KCID, Southeast University, E2DesignLab and REALMStudio.

In addition, in the past two years Monash University's Faculty of Arts, Design and Architecture ran a design studio involving its masters and PhD students in Kunshan to generate new design ideas for the city.

Now Kunshan is embarking on an ambitious new \$1 billion project aimed at opening new pathways to market, and new partnerships between Chinese and Australian businesses for the transfer and application of Australian water sensitive knowledge in the region.

# ATSE PEOPLE

## Three Fellows head latest Honours list

Eminent medical researcher Professor Peter Colman AC FRS FAA FTSE, aviation business leader Mr Alan Joyce AC FTSE and WA Chief Scientist Professor Peter Klinken AC FTSE were named in the 2017 Queen's Birthday Honours List, heading a group of eight ATSE Fellows honoured for their service to Australia.

**Professor Peter Colman** was honoured "For eminent service to medical research, particularly in the fields of structural biology and medicinal chemistry, as a leader in the commercial translation of scientific discoveries, to professional organisations, and as a mentor of young scientists."

He has headed the Structural Biology Division, Walter and Eliza Hall Institute of Medical Research, since 2001 and chairs the Performance Review Committee, as well as being a Board Member of the Burnet Institute for Medical Research and Public Health.

He was a Board Member, Australian Synchrotron (2009–13); Founding Board Member, Starpharma (1997–2008); Director, Biomolecular Research Institute (1991–2001); and Founding Board Member, Biota Holdings (1985–91).

He was chief of the CSIRO Division of Biomolecular Engineering (1989–97). At CSIRO he initiated the research and development of the anti-influenza drug Relenza and has won numerous awards and medals.

**Mr Alan Joyce** was honoured "For eminent service to the aviation transport industry, to the development of the national and international tourism sectors, to gender equity, inclusion and diversity, and to the community, particularly as a supporter of Indigenous education."

He has been CEO and Managing Director of Qantas Airways Ltd since 2008. He is a Governor of the Oneworld Alliance; has been a Business Council of Australia Board Member since 2013; Ambassador,

Australian Indigenous Education Foundation, since 2012; and Founding Member, Male Champions of Change, since 2010.

He is a Fellow of the Royal Aeronautical Society. He was named for Outstanding Contribution to Global Aviation by the Irish Aviation Industry in 2016; and Orient Aviation Person of the Year 2016.

**Professor Peter Klinken** was honoured "For eminent service to medical research and biochemistry through seminal contributions to understanding the genetics of major diseases, and to the people of Western Australia through promoting the importance of science and innovation."

His service includes: Chief Scientist of Western Australia since 2014; Chair, Premier's Science Awards; and member of various scientific advisory committees including Children's Cancer Research Australia, Lions Eye Institute and Bioplatforms Australia.

He was the Director, Centre for Medical Research (2002–14) at the University of Western Australia; Professor of Clinical Biochemistry

Peter Colman



Graeme Bird



Alan Joyce



Peter Klinken

## CRAIG SIMMONS NAMED 2017 WATER PROFESSIONAL

Internationally recognised hydrogeologist Professor Craig Simmons FTSE has been named 2017 Australian Water Professional of the Year by the Australian Water Association, Australia's peak water industry body.

The national award honours an individual who has displayed passion and commitment to the water industry, while also demonstrating leadership and influence.

Professor Simmons is Professor of Hydrogeology and Schultz Chair in the Environment at Flinders University and director of the National Centre for Groundwater Research and Training (NCGRT), headquartered at Flinders University.

A Deputy Chair of ATSE's Water Forum, he is passionate about ensuring the survival and

quality of Australia's important groundwater supplies.

"In Australia, groundwater accounts for around one-third of our total water consumption and in the past few decades, Australia has more than doubled its groundwater use. Groundwater is front and centre in many contemporary pressing issues," Professor Simmons says.

"Water scarcity reached crisis point in Australia in the Millennium Drought and, by some estimates, Australia's population could near double in the next 50 years. Climate change is expected to bring drier conditions to already dry parts of the continent.

"Understanding the vital links between water, energy, food, environment, climate and

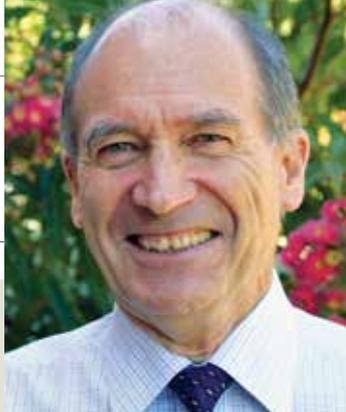
population are massive global challenges. Advancing these issues will require rigorous groundwater science, management and policy. It will require long-term planning well beyond political and drought cycles."

The NCGRT has a wide range of research projects, from the Murray–Darling Basin and Great Artesian Basin to international groundwater projects in Sub-Saharan Africa, Vietnam and China.

It is also two years into a significant study of the groundwater of the Pilbara mining region of north-western Western Australia.

Working with resources giant Rio Tinto, Professor Simmons is currently leading a major Australian Research Council Linkage grant studying 'groundwater mixing' in the

# ATSE PEOPLE



*Geoffrey Fincher*

(1994–2004); and Senior Fellow, Harry Perkins Institute of Medical Research (2014–16) He was named WA Citizen of the Year (professional category) in 2008.

**Emeritus Professor Graeme Bird** AO FTSE was honoured “For distinguished service to aeronautical engineering, particularly in the field of molecular gas dynamics, as a researcher and academic, to professional scientific organisations, and as a mentor of young scientists.”

Professor Bird was Lawrence Hargrave Professor of Aeronautical Engineering and Head of Department, University of Sydney (1964–90) and has been a visiting professor at Imperial College London, California Institute of Technology (Caltech), the University of Manchester, the Max Plank Institute and the Hong Kong University of Science and Technology.

He has been a consultant to the National Aeronautics and Space Administration (NASA) for some 40 years and is a Fellow of Engineers Australia, the American Institute for Aeronautics and Astronautics and the Royal Aeronautical Society; and a Member of the US National Academy of Engineering.

**Emeritus Professor Geoff Fincher** AO FTSE was recognised “For distinguished service to science, and to education, in the area of plant genomics, as an academic, researcher and administrator, through scientific advisory roles, and to international professional societies.”

He was the University of Adelaide’s Professor and Head of Department of Plant Science (1993–2001) and Director, Waite Campus (2003–10). He was Senior Lecturer and Reader in Plant Biochemistry, La Trobe University (1982–92).

He was a member of the SA Science Council (2015–17), Founding Director, ARC Centre of Excellence in Plant Cell Walls (2011–14) and Deputy CEO, Australian Centre for Plant Functional Genomics (2003–10).



*Craig Simmons*

open pit mining region.

“The research has widespread implications for better scientific understanding of the effects of these mines on the regional flow system, and what that means for groundwater in the future,” Professor Simmons says.

“Unravelling groundwater chemistry and groundwater

ages obtained from long screened wells will help inform the industry’s mining practices and environmental management, particularly in relation to dewatering bores and long-term trends in groundwater levels. Decommissioning mine sites is a major national and international issue. Understanding groundwater behaviour is fundamental to this issue.”



*Margaret Sheil*

**Professor Margaret Sheil** AO FTSE, was honoured for “For distinguished service to science and higher education as an academic and administrator,

through significant contributions to the national research landscape, and to performance standards.”

She has been University of Melbourne Provost since 2012 and was previously CEO of the Australian Research Council (ARC) (2007–12), and University of Wollongong Deputy Vice-Chancellor (Research) (2005–07) and Pro Vice-Chancellor (2002–05).

Professor Sheil is an ATSE Director and a Director of ANSTO and has served on the Prime Minister’s Science Engineering and Innovation Council, the National Research Infrastructure Council and the Cooperative Research Centres Committee.

**Dr Katherine Woodthorpe** AO FTSE was recognised “For distinguished service to business through venture capital, management and commercialisation initiatives for research and technology based enterprises, and to industry organisations.”

Her service includes: Chair, Antarctic Climate and Ecosystems CRC, since 2002 and HEARING CRC since 2016; Director, Deep Exploration Technologies CRC, since 2013, Cancer Therapeutics CRC (2014–16), Capital Markets CRC, since 2014, and Environmental Biotechnology CRC (2002–07).

She is a Director of the Australian Renewable Energy Agency (ARENA) (since 2016) and has been Chair, National Climate Science Advisory Committee, since 2016. She has been a Director, Olivia Newton-John Cancer Research Institute (since 2014). She served as CEO, Australian Private Equity and Venture Capital Association (2006–13) and is a former Director of the Warren Centre.

**Dr Alexander Zelinsky** AO FTSE, was honoured “For distinguished service to defence science and technology, to systems engineering, and to education as an academic and researcher.”

Dr Zelinsky has been Chief Defence Scientist and Head of Defence Science and Technology since 2012 and was previously Group Executive, Information Sciences Group, CSIRO (2009–12) and Director of CSIRO’s ICT Centre Business Unit, (2004–09). Before that he was Professor, Systems Engineering, at the Australian National University.

He is Chair of the Advisory Board for the ARC Centre of Excellence in Robotic Vision, an Honorary Fellow of Engineers Australia and won a 2005 Clunies Ross Award.



*Alex Zelinsky*



*Katherine Woodthorpe*

# ATSE PEOPLE

## Three ATSE Fellows join Academy of Science

The Australian Academy of Science has elected 21 new Fellows, recognising them for their outstanding contributions to science and scientific research, including three ATSE Fellows – Professor Ian Chubb AC FAA FTSE, Dr Anita Hill FAA FTSE and Professor Branka Vucetic FAA FTSE. Six of the 21 were women.

Professor Chubb has been a strong and effective advocate for government and industry support of innovation and research in science, technology, engineering and mathematics (STEM) over several decades.

Throughout his career, including as Vice-Chancellor of the Australian National University (2001–11) and as Chief Scientist of Australia (2011–16), he made significant contributions to improving the infrastructure for scientific research and training and was conspicuous in raising the public profile of science in the media.

He was made a Companion in the Order of Australia in 2006 for his “service to higher education, including research and development policy in the pursuit of advancing the national interest socially, economically, culturally and environmentally,

and to the facilitation of a knowledge-based global economy”.

He was the ACT Australian of the Year in 2011 and has received six honorary doctorates. In 2016 he was awarded the Australian Academy of Science Medal for his outstanding contributions by sustained efforts in the public domain, which have significantly advanced the cause of science and technology in Australia.

Dr Hill is CSIRO’s Executive Director Future Industries and has been a Fellow since 2008. Her research is in materials and process engineering and, more specifically, in the transport of atoms, ions and small molecules in condensed matter.

She has developed positron methods for measurement of open volume in condensed matter on the Ångström-scale, which is crucial for the transport of small molecules.

Her focus on measurement has provided an understanding of the controlling factors involved in selective small molecule transport and her data has been pivotal to the development of theory and design rules for membrane performance.

Professor Vucetic – from the University of Sydney’s School of Engineering – has made

fundamental contributions to the science of coding theory, which underpins all modern telecommunications techniques. Her research has had a major impact, especially in areas of code division multiple access (CDMA) systems, adaptive modulation, Wi-Fi networks, and wireless multi-way relay networks.

Her work has yielded basic theories, algorithms, major applications in areas such as smart grids and cellular networks. She is highly cited and has co-authored four advanced textbooks in wireless communications and coding.

In 2014, Professor Vucetic was awarded the Chinese Government Friendship Award for her contributions to education, science and technology in China.



Ian Chubb



Anita Hill



Branka Vucetic

## FELLOWS SPREAD THE WORD IN REGIONAL WA

Fellows Professor Lyn Beazley AO FTSE and Professor Adrian Egan FTSE were key players at an event in regional Western Australia to promote community engagement in science.

They gave presentations to about 40 community leaders in Mandurah, a resort city 100 kilometres south of Perth, which aimed to inspire the creation of a science or ‘knowledge’ council for the surrounding Peel region to promote community engagement with science.

They were joined by Carmen Smith, WA Manager of the Inspiring Australia program.

The event was supported by the Peel Development Commission and Regional Development Australia Peel, with an audience of key regional educators, industry leaders, science facilitators, regional politicians and local government representatives.

The messages were about science,

innovation and creativity for a community-wide and coordinated program to reinforce, discover and develop the many regional opportunities and meet challenges in industry, value adding, environmental protection, tourism, employment and education.

Professor Beazley, formerly WA’s Chief Scientist, lives in Mandurah, the principal city in the Peel region, located between Perth and the South West region, which is centred on Bunbury, where Professor Egan lives.

Professor Egan, Chair of the South West Science Council, traced the two-year journey of the Council as an example of a body that advocates, facilitates, coordinates and conducts activities in STEM education, citizen science and innovation in industry.

He said community conferences held by the Council had led to a suite of new science projects for schools and community members in natural resource management and agriculture in the region.



Under the trees in Mandurah: (from left) Paddi Creevey, chair RDA Peel, Adrian Egan, Lyn Beazley, Sue Fyfe, Deputy Chair Peel Development Commission and Carmen Smith.

# ATSE PEOPLE

## Louis Challis a leading acoustical engineer

Mr Louis Challis AM FTSE spent his life making unwanted noise and vibration inaudible and making good noise crystal clear.

Mr Challis had a reputation as Australia's leading acoustical engineer. He provided outstanding acoustical designs for some of Australia's most prestigious buildings.

Foremost among these was his eight-year involvement in the architectural acoustic design and supervision of Parliament House in Canberra.

Other landmark public buildings and infrastructure projects include: the Parliament houses of New South Wales, Queensland and Papua New Guinea; the Sydney Olympics 2000 project at Homebush Bay; and the Sydney Harbour Tunnel.

In the 1970s, he developed an audio-tactile push-button signalling system, so impaired pedestrians could easily use traffic control lights.

Although the NSW Department of Main Roads offered him the right to patent his invention, he declined on the basis that he

believed the innovation should be made as widely available as possible at the lowest possible cost. The system he designed is now used around the world.

His professional career pervaded his life. When he built a new family home in the 1970s in Dover Heights, in Sydney's east, he selected a site on a hillside to enable him to build a full-size acoustic laboratory, including a reverberation chamber the size of a squash court.

When working on Parliament House in Canberra, Mr Challis and his team tested for three months the acoustical properties of prospective materials, using a 1:10 scale model of the House of Representatives chamber in a space big enough to do so – the living room of his home.

After matriculating from Canterbury Boys High in 1953, Mr Challis completed a bachelor of electrical engineering at the University of Sydney, followed by a master of architectural science. His first job on graduation was in underwater acoustics for the Royal Australian Navy. After working there and OTC (now part of Telstra), he started Louis A. Challis & Associates in 1966.



Louis Challis in 2000.

His wife, Anna, left her career as a geophysicist in 1973 to work with Challis in his practice. Over the next 40 years, they worked together building a successful practice.

Mr Challis served in the RAAF Reserve as a specialist adviser in acoustics, where he attained the rank of Wing Commander. He was also a specialist adviser on forensic assessment of tapes for ASIO, the NSW Independent Commission Against Corruption and the NSW Crime Commission.

He served on many committees to develop acoustical standards and wrote hundreds of reviews of hi-fi equipment for leading electronic magazines. His approach was unusual in that it combined objective laboratory testing with subjective experience.

He was elected a Distinguished Corresponding Member of the Institute of Noise Control Engineering of the US in 1993 and an Honorary Fellow of Engineers Australia in 1998.

He received a Doctorate of Engineering (honoris causa) from the University of Sydney in 2015.

He died in Sydney on 3 June after a long illness.

(An edited obituary by his son, Darren Challis.)

## MARTIN COLE WINS US FIRE PROTECTION AWARD

Dr Martin Cole FTSE, a world leader in smoke-detection technologies, is one of three industry leaders awarded the US National Fire Protection Association 2017 DiNenno Prize for the Very Early Smoke Detection Apparatus (VESDA) technology.

The DiNenno Prize recognises groundbreaking innovations that have a significant impact in the building, fire and electrical safety fields worldwide.

Dr Cole won the award – and the US\$50,000 prizemoney, presented at the NFPA's Conference and Expo in Boston – with two other Australians, Mr David Packham and Mr John Petersen.

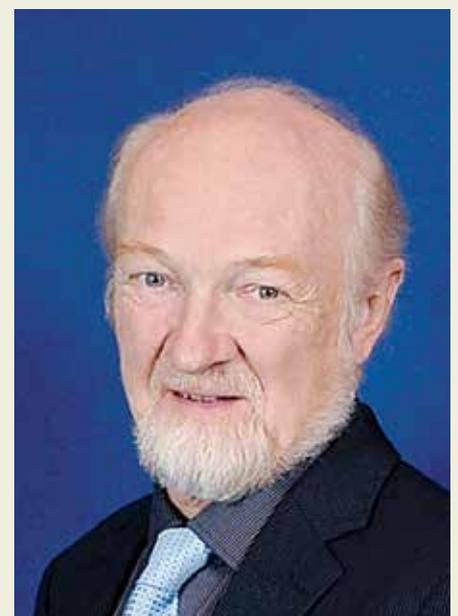
The nominator was Mr Peter Johnson FTSE, another leading figure in fire safety protection in Australia and head of fire safety

at Arup, who said VESDA has transformed detection applications, changed codes and standards, and positively impacted life-cycle maintenance and testing for many facilities.

Melbourne-based security electronics firm IEI Pty Ltd took on the challenge of developing and commercialising the VESDA technology, which originated at CSIRO.

IEI introduced its first product to overseas markets in 1983 and built increasingly sophisticated versions for Australian and world markets.

Dr Cole founded IEI and is regarded as pioneer of the aspirated smoke-detection industry worldwide. His VESDA™ and Aspire™ technologies were sold in 1995 (eventually to Honeywell), while his newer Monitair™ and Asyst™ technologies were sold to Siemens in 2007. He has received numerous awards for research, design and for export marketing.



Martin Cole

# ATSE PEOPLE

## Bruce Hobbs wins international acclaim

Professor Bruce Hobbs AO FAA FTSE, former Chief Scientist of Western Australia, has received a Science Excellence Award in structural geology by the International Union of Geological Sciences (IUGS) for his outstanding achievements in earth sciences and contributions to the scientific and public community.

The IUGS noted Professor Hobbs' "outstanding original contributions" in the field of earth sciences.

The IUGS noted that for more than 55 years Professor Hobbs had researched structural geology and tectonics "from lithospheric to microscopic scale".

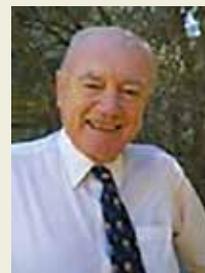
He was acknowledged not only an enthusiastic and innovative scientist and supervisor of numerous students but as an adviser, founder and director of various research

institutions, amounting to a tremendous contribution to the wealth of society.

Professor Hobbs is a CSIRO Research Fellow and Adjunct Professor at the University of WA. He was WA Chief Scientist and headed the WA Office of Science and Innovation from 2003–06.

He was Foundation Professor of Geology and Chairman, Department of Earth Sciences, at Monash University (1972–84), after a career in geology at the University of Sydney, UCLA, ANU and State University of New York.

He spent two decades with CSIRO serving in a variety of roles which culminated in Chief, Division of Exploration and Mining (1992–2000), Deputy Chief Executive, Minerals and Energy (2000–01) and Deputy Chief Executive, CSIRO Strategic Investment Planning (2001–03).



Bruce Hobbs

His other roles have included: Member, Australian Research Grants Committee; Director, CRC for Mining Technology and Equipment; and Member, Australian Science and Technology Council (ASTEC).

Professor Hobbs has won numerous awards – Fullbright Awards, Jaeger Medal (AAS) and US Antarctic Research Program Medal.

He has been a Fellow since 2006 and in 1995 The Geological Society of Australia struck the Bruce Hobbs Medal, awarded every two years to an individual who has made significant contributions in Structural Geology.

## ROLF PRINCE DOMINATED CHEMICAL ENGINEERING

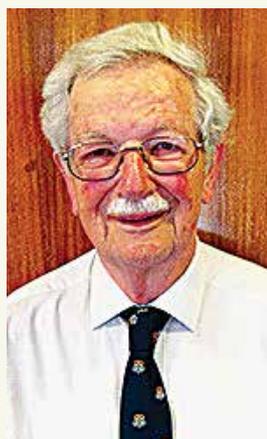
Professor Rudolph (Rolf) Prince AO FEng FTSE, one of Australia's most influential chemical engineers and educators, died in Sydney on 4 July, aged 88.

His work with the Academy has left a lasting legacy and he will be sorely missed and fondly remembered.

Rolf Prince was born in Germany in 1928 and moved to Italy in 1936 with his mother and sister, then to England in 1938, and then New Zealand, where he studied Chemical Engineering at the University of Canterbury, graduating BE and BSc.

He then lectured in chemical engineering at the University of Sydney for the next four years (1950–53) before moving to the UK and joining Distillers as a process engineer. He was awarded his PhD by Sydney in 1957.

In 1958 he returned to New Zealand as a lecturer in chemical engineering at Canterbury and then in 1960 moved to Australia and became Senior Lecturer in chemical engineering at Sydney, before being appointed Professor at the University of Queensland in Brisbane in 1965.



Rolf Prince

In 1969 he returned to Sydney, this time as Professor of Chemical Engineering and Head of Department, where he remained until his retirement in 1998.

He was until his death an Emeritus Professor and continued his active involvement in the field of chemical engineering.

Professor Prince was an outstanding researcher, educator and stalwart supporter and leading example of the profession of chemical engineering and was influential in the training of many of Australia's leading chemical engineers.

He was a highly respected and much valued senior figure in our Academy. In his 27 years as a Fellow his influence was immense and he worked tirelessly to promote technological sciences and engineering.

He served on the ATSE Council (1998–2001) and was an active member of the NSW Division Committee for more than 14 years, including as the Division Chair (1998–2001).

Importantly he helped shape the Academy through his work on the Membership Committee (2003–09), serving as Chair of the Committee (2007–09).

He was President of the Institution of Chemical Engineers following two terms as Vice President and was active in IChemE in Australia – Foundation Member, Secretary and Chairman.

He served on the Institution of Engineers Council and Executive, was Chair of its College of Chemical Engineers. He was also active in the Australian Institute of Petroleum (NSW Branch Chair) and the Asian Pacific Confederation of Chemical Engineering (as Vice President then President, 1987–93).

# ATSE PEOPLE

## Sue Barrell named a Superstar of STEM

Bureau of Meteorology Chief Scientist Dr Sue Barrell FTSE has been named one of 30 Superstars of STEM by Science and Technology Australia.

STA says it is working with 30 of the nation's most dynamic scientists and technologists to create role models for young women and girls, and work towards equal representation in the media of men and women in STEM.

It plans to equip the Superstars with advanced communication skills and connect participants through a mentoring network, to encourage them to learn from women who have crafted a profile for themselves and who already serve as role models.

Dr Barrell joined the BoM in 1980. As Chief Scientist she has responsibility also for Diversity, Inclusion and STEM.

From 2004, she was Branch Head,



Sue Barrell

Observations and Engineering, bringing an integrated focus to the BoM's observing systems and establishing an enterprise data framework. Prior roles included climate science policy, integrated system design, research and operational forecasting.

As Division Head, Observations and Infrastructure, from 2014, Dr Barrell oversaw the sustained operation of Australia's meteorological infrastructure, delivering comprehensive observations of the earth system to underpin Bureau services.

She was Australia's Principal Representative to the World Meteorological Organization (WMO) and a member of WMO Executive Council (2016–17), and served eight years as Australia's Principal Delegate to the Group on Earth Observations.

She was Vice President, WMO Commission for Basic Systems (2008–16) and continues to co-chair several high-level WMO initiatives.

research and development on energetic materials.

During his time at DSTO, Dr Dagley undertook a 15-month attachment to the Naval Surface Warfare Centre in Maryland, USA, where he contributed to the US Navy's explosive synthesis program.

As Chief Scientist at Beta Chemicals (1981–85), Dr Dagley developed many adhesive and plastic formulations that were adopted by the manufacturing industry in Australia. Prior to this, he had a two-year appointment as a postdoctoral fellow undertaking organic synthesis research at Oxford University.

Dr Dagley is a member of the Victorian Division Committee of the Australian Academy of Technology and Engineering. He was a former member of the Board of the CRC for Polymers and the Board of the CRC Association, and was also a member of a number of Plastics and Chemicals Industries (PACIA) Advisory Councils.



Ian Tyler with his award.

## GIBB MAITLAND MEDAL TO IAN TYLER

Geoscience mapping has come a long way from hand-drawn maps to today's detailed online digital images.

Dr Ian Tyler FTSE, Geological Survey of Western Australia (GSWA) Assistant Director Geoscience Mapping, has played an integral role in guiding that transformation.

Dr Tyler's contribution to geoscience over the past 35 years was acknowledged when he was presented with the Geological Society of Australia Western Australian Division's 2017 Gibb Maitland Medal.

Eminent geoscientist and former WA Chief Scientist Professor Bruce Hobbs AO FAA FTSE, who nominated Dr Tyler for the medal, presented the citation outlining his extensive achievements at the awards event.

"Since commencing with the Geological Survey of Western Australia in 1981, Ian Tyler's work has been directed towards developing a coherent understanding of the state's geology through careful and systematic field mapping, successfully integrated with multidisciplinary studies," Professor Hobbs said.

"He is recognised nationally and internationally as one of Australia's leading regional geologists and the quality of work produced by mapping teams led by Ian is of a standard that is arguably unsurpassed by any mapping group in Australia."

Dr Tyler said being nominated by Professor Hobbs made receiving the medal even more special given that he still treasures his first edition of the textbook *An Outline of Structural Geology*, co-authored by Professor Hobbs and published in 1976.

## IAN DAGLEY MOVES TO DSTG ROLE

Dr Ian Dagley FTSE is now heading up the Defence Science Technology Group's Science Partnerships and Engagement Division, after 20 years as the CEO of the Cooperative Research Centre for Polymers, one of the most scientifically and commercially successful operations in the CRC Program.

Dr Dagley's new role marks his return to DSTG, where he spent 10 years (1985–95) as a researcher with what was then called the Defence Science and Technology Organisation.

In 1992 he became Head of Explosives and Propellants at the Melbourne site, leading a team conducting both long-term and applied



Ian Dagley

# ATSE PEOPLE

## Buddhima Indraratna to head new rail training centre

University of Wollongong Professor Buddhima Indraratna FTSE will head the new ARC Training Centre for Advanced Technologies in Rail Track Infrastructure, announced by the Australian Research Council.

Professor Indraratna is one of Australia's foremost experts on railway infrastructure and the Foundation Director of the Centre for Geomechanics and Railway Engineering, the country's first track research centre, established two decades ago.

The ARC Training Centre for Advanced Technologies in Rail Track Infrastructure (ITTC-Rail) aims to transform Australian rail industry by creating a sustainable training program between industry and Australian Universities.

In partnership with rail asset owners, consultants and contractors, the Centre plans to prepare the next generation of industry professionals and dynamic researchers, and develop the materials, construction systems

and design innovation that will transform the rail industry towards an advanced manufacturing future.

Professor Indraratna says ITTC-Rail will be a unique national centre for doctoral and postdoctoral training innovation. Its research outcomes will focus on cutting-edge rail industry transformation and enhance technological expertise to underpin future high-performance tracks.

He notes that rail transport is an inherent component underpinning the Australian economy, in particular through the transport of natural resources, such as coal and iron ore to port, but increasing demand has required heavier and faster trains leading to rapid deformations and degradation of the ballast layer. This, in turn, adversely affects track stability and increases the frequency of track maintenance.

"Irrespective of advanced technologies in rolling stock, including computerised

driverless systems to high speed electric engines, it is the variations and uncertainties in the ground (nature) that offer the greatest challenges and impediments, hence the utmost importance of research training of young professionals in the field of rail track technologies," he says

The new rail track centre is one of nine ARC new industrial training research centres announced in June that will be funded to \$37 million under the Government's ARC Industrial Transformation Research Program – designed to encourage and support university-based researchers and industry to work together to find solutions to a range of issues facing Australian industries.



Buddhima Indraratna

## DAVID ABRAMSON TAKES THE PRIZE

The University of Queensland Research Computing Centre Director Professor David Abramson FTSE represented UQ when the university received a merit award in Brisbane as a state finalist in the Australian Information Association's iAwards.

UQ received the award for significant innovations around data-intensive infrastructure, in particular the FlashLite high-performance computer and the Metropolitan Data Caching Infrastructure (MeDiCI), a high-performance storage fabric. These systems store and process large amounts of research data, involving computers and instruments on campus and computers and storage off-site.

MeDiCI delivers ultra-fast, multi-site data access on demand without user involvement, saving researchers valuable time to focus on their work. FlashLite, the RCC-designed specialist high performance computer for data-intensive science, has a novel storage and processing hierarchy that includes large amounts of main memory and solid-state disk (flash memory).

Receiving a merit award puts UQ and RCC in the running for a national iAward, to be announced in Melbourne on 30 August.

The iAwards recognise technology innovations that have the potential to, or are already having, a positive impact.



David Abramson collects the award for UQ

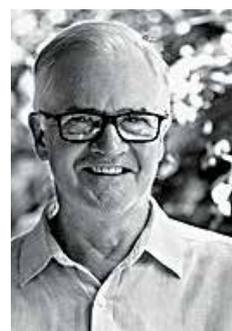
## ARCHITECTS HONOUR MICHAEL KENIGER

Leading Queensland architect Professor Michael Kenniger FTSE has been named winner of the Institute of Architects 2017 National President's Prize and described as a "remarkable architect".

"As a leader, academic, advocate, adviser, critic, writer and mentor he has made an incredible contribution to our profession and society with dedication, humility and humanity," his citation notes.

It references his long career with the University of Queensland, including roles as Head of the Department of Architecture and Dean of the Faculty, then Senior Deputy Vice-Chancellor and Senior Vice-President of the university.

"Michael has shaped public policy and directly influenced the design quality of major urban and public projects in Queensland, achieved through his former role as the Queensland Government



Michael Keniger

Architect, and through the Urban Futures Brisbane Board, Queensland's Urban Land Development Authority and the South Bank Corporation Design Review Panel and Board."

A Fellow since 2005, he is currently Chair of the Brisbane Airport Development and Design Integrity Panel.

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# Creating change in dementia research

**As our population ages, dementia will become one of the biggest health problems of our time. Queensland Brain Institute (QBI) researchers at The University of Queensland (UQ) are one step closer to finding a non-invasive treatment for Alzheimer's disease.**

More than 400,000 Australians live with dementia, including Alzheimer's disease, a condition with no known therapies that stop or reverse its progression. But researchers from UQ's Queensland Brain Institute have made a breakthrough discovery involving non-invasive ultrasound technology. They have discovered that ultrasound technology can be used to reverse Alzheimer's symptoms and restore memory in animal models.

The research, conducted by Professor Jürgen Götz and his team, holds potential for treating Alzheimer's disease without using drug therapeutics. The ultrasound innovation transiently opens the blood-brain barrier, activating cells to remove toxic

plaques that build-up in Alzheimer's disease. The exciting next stage of the research is to translate the findings into a therapy for patients in coming years.

The remarkable success of UQ's Queensland Brain Institute is demonstrated through important advances in fundamental neuroscience and in diseases such as ageing dementia, schizophrenia and motor neuron disease. For more information, visit [qbi.uq.edu.au](http://qbi.uq.edu.au)

The Federal Government's 2015 Excellence in Research for Australia exercise confirmed The University of Queensland as one of the nation's top three universities, measured by the quality of its comprehensive range of specialised research fields. UQ's outstanding critical mass offers researchers significant interdisciplinary capability.

Join more than 4,000 students currently pursuing a research higher degree at UQ. Visit [graduate-school.uq.edu.au](http://graduate-school.uq.edu.au)



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