ANU reporter

The Australian National University

Summer 2011

Australian National University

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Vice-Chancellor's introduction

You will no doubt be aware that the ANU community has been celebrating Brian Schmidt's magnificent achievement in winning the 2011 Nobel Prize for Physics, for his work on the nature of the universe.

He got the call on a Tuesday night, and that week was a whirlwind. On Wednesday he met the Prime Minister, took a congratulations call from the White House and educated the world's media on the nature of dark matter.

But through all the comments he made that week the ones that have stayed with me are ones he delivered to 1,000 of his colleagues packed into every spare corner of the hall at University House at week's end.

He reminded us that basic science research creates revolutionary new ideas, but that it is a messy process that doesn't always deliver what you might expect. He explained that he came to Australia and ANU because he wanted to work with the best, but that here there was simply more freedom to pursue the big questions unencumbered by pressure to reach a particular result, than in the US and other places.

He told us that the questions that fascinate him are the really big ones, ones he could explain to his children or his parents, like the size of the universe.

He tried to convince us that he wasn't a genius, and that his story was like many others at this University, and in some senses he is right.

He reminded us what we are here at ANU for, to work hard – not alone, but with our colleagues, across institutions and across disciplines – and to try and find answers to the big questions.

You can read part of Brian's story in this month's edition of *ANU Reporter*, but also the stories of many others, who, like the Nobel Prize winner, are trying to find answers to the questions that fill their minds.

Professor Ian Young
Vice-Chancellor and President

ROWING ON A MISTY MORNING BY ADAM SPENCE

Combined law and arts student Adam Spence recently took out gold in the press category of one of the world's most prestigious photographic awards – the 2011 Prix de la Photographie Paris competition.

The prize recognises Spence's photo of rowers training on Canberra's Lake Burley Griffin during winter. The photo was judged by a panel of internationally-renowned experts from the photography industry and will appear in the prize's annual publication of winning photos.

Check out more of Spence's photos online at www.adamspence.com.au

Cosmic thread that binds us revealed

Astronomers at ANU have found evidence for the thread that forms the fabric of the universe.

The researchers discovered proof of a vast filament of material that connects our Milky Way galaxy to nearby clusters of galaxies, which are similarly interconnected to the rest of the universe.

The team included Dr Stefan Keller, Dr Dougal Mackey and Professor Gary Da Costa from the Research School of Astronomy and Astrophysics.

"By examining the positions of ancient groupings of stars, called globular clusters, we found that the clusters form a narrow plane around the Milky Way rather than being scattered across the sky," says Dr Keller.

"Furthermore, the Milky Way's entourage of small satellites are seen to inhabit the same plane. What we have discovered is evidence for the cosmic thread that connects us to the vast expanse of the universe."

Sunshine keeps ANU in the black… and green

ANU will reduce its carbon emissions by a further 19 tonnes each year thanks to new solar panels installed on the rooftop of the University's Student Concessions Building.

Launched by Parliamentary Secretary for Sustainability and Urban Water, Senator the Hon Don Farrell (pictured), the photovoltaic (PV) array of 60 solar panels, with 14 kilowatts capacity, will feed over 21,000 kilowatt hours of green energy into the ANU electricity grid each year – the equivalent annual energy needs of five average Canberra households.

The installation of the PV array is a joint project between the Department of Sustainability, Environment, Water, Populations and Communities, and ANU.

Going with the flow nets researchers Eureka Prize

A team of ANU researchers and a colleague from the University of Melbourne have won one of the nation's most prestigious science prizes – an Australian Museum Eureka Prize.

Professors Quentin Grafton (pictured) and Tom Kompas and Dr Hoang Long Chu from the Crawford School of Economics and Government have taken out the water and innovation category in the 2011 prizes.

ANU to share research with the world

Dr Danny Kingsley. *PHOTO BY JAMES GIGGACHER.*

The latest breakthroughs, discoveries and thinking from ANU will now be an open book for the wider world with the launch of a revamped online research collection.

The Digital Collections will freely share ANU research with the rest of the world by making public over 400 theses, almost 4,000 research papers and 2,000 images.

The revamp of the University's research collection was supervised by the manager of scholarly communication and e-publishing at ANU, Dr Danny Kingsley. She will now coordinate the new database.

"The Digital Collections provides an opportunity for our researchers to easily share their research," says Dr Kingsley. "Making research open access means it is not only available to other scholars in universities with less resources, but it is available to practitioners in a field, like pharmacists or economists, who can't keep up with recent research because their organisation doesn't subscribe to scholarly journals. It also means the general public trying to find information about disease or environmental issues can look up the latest findings themselves." ■

- The Digital Collections can be accessed at digitalcollections.anu.edu.au

ANU Tall Poppies pick of the bunch

Three ANU researchers have won 2011 ACT Young Tall Poppy Science Awards.

Dr Cormac Corr, Dr Gonzalo Estavillo and Dr Liana Leach were the three winners from ANU. Dr Leach from the Centre for Mental Health Research was recognised for her research into the widespread impacts of mental illness on individuals, families, workplaces and the economy.

Dr Corr from the Research School of Physics and Engineering was rewarded for his work on plasma. The Research School of Biology's Dr Gonzalo Estavillo received the accolade for his research into plant defence mechanisms and how they survive conditions such as very hot and dry seasons. ■

Dr Liana Leach. *PHOTO BY MARTYN PEARCE.*

Professor Ian Young at the launch of ANU by 2020. *PHOTO BY MARTYN PEARCE.*

New plan for ANU future

The future direction of ANU has been outlined with the launch of a new strategic plan.

Seven months after his appointment to lead ANU, Vice-Chancellor Professor Ian Young has issued *ANU by 2020*. The plan will guide the development of the University over the next decade.

"The plan is focused on boosting excellence in three key areas: research, education and our role as a public policy resource for the nation and the region," says Professor Young.

"*ANU by 2020* contains an ambitious but achievable set of goals and targets. It will build the University's profile as both Australia's national university and Australia's finest university.

"The plan recognises the increasingly competitive national and global environment and the need to innovate to remain the university of choice for staff, students, government, business and other groups.

"By 2020 ANU will be the unequivocal national leader in contribution to public policy analysis and formulation. Staff will be encouraged not only to excel in their field, but to take part in and improve the quality of public debate on the critical issues of our time.

"The vast majority of ANU academic staff will be research-active, and our education will continue to be grounded in what we research. Students at all levels will experience the unique research culture of ANU.

"Staff will win more competitive research grants and more staff will be ranked world-class and above world-class on the Commonwealth's Excellence in Research for Australia (ERA) scale.

"ANU staff will continue to excel as teachers, and ANU will continue to perform above the Group of Eight (Go8) universities average on a number of key measures, including course satisfaction, graduate employment rates and the proportion of students entering postgraduate study.

"ANU will establish a fund to attract and retain new world-class staff, at senior and mid-career levels, in areas of strategic importance.

"By 2020 ANU will be an even more vibrant community of scholars than it is today – focused on the critical issues that will shape our future."

- The plan can be found at: anu.edu.au/about/strategy

Graeme Samuel joins ANU Council

Former Chairman of the Australian Competition and Consumer Commission Graeme Samuel AC (pictured) has been appointed a member of the ANU Council.

Mr Samuel will take his place on the Council as one of the seven members appointed by the Minister on the recommendation of the Nominations Committee of Council. He replaces Justice Annabelle Bennett AO, who stepped down as a council member after 15 years.

Mr Samuel joins the Council following a distinguished and significant career in both the corporate and government sectors. These have included roles as Associate Member of the Australian Communications and Media Authority, President of the National Competition Council, Chairman of the Melbourne and Olympic Parks Trust, Commissioner of the Australian Football League and Chairman of Opera Australia.

New deal helps disadvantaged kids study

A new relationship between ANU and The Smith Family will aim to improve educational opportunities and increase access to university for young Australians from disadvantaged backgrounds.

Signed by ANU Vice-Chancellor Professor Ian Young and The Smith Family CEO Dr Lisa O'Brien, the cooperative relationship agreement will support The Smith Family's Learning for Life program – which assists disadvantaged children and young people from pre-school to tertiary studies.

As part of the agreement, ANU will provide additional scholarships to students through the ANU Endowment for Excellence and will collaborate with The Smith Family to provide a range of other initiatives including tutoring, mentoring, university visits and enrichment programs.

ANU congratulates new ARC Laureates

ANU Vice-Chancellor Professor Ian Young has congratulated the three ANU researchers who have won an Australian Research Council 2011 Australian Laureate fellowship.

The ANU Laureates are Professor Martin Asplund from the Research School of Astronomy and Astrophysics, Professor Craig Moritz (pictured) from the Research School of Biology and Professor Mahananda Dasgupta from the Department of Nuclear Physics – who also won the Georgina Sweet Australian Laureate.

life sentences

The Australian Dictionary of Biography (ADB) sits in the history program at the Research School of Social Sciences. ADB Research Editor **BARBARA DAWSON** explores a life-history that can be found in our hip pockets.

Have you looked at the portrait on a $50 note lately? There you will see the face of the Indigenous high-flyer, David Unaipon (1872-1967).

David Unaipon was a man of innate intelligence who, with the aid of education, was able to become an inventor and an author. Born in 1872 at the Point McLeay Mission, South Australia, the son of a congregational evangelist, David attended the mission school for six years from the age of seven. Afterwards, he learned boot making, but education led him to other fields. He loved music and he played the organ; he read widely, becoming interested in philosophy and science.

By 1909 Unaipon had developed and patented a modified handpiece for shearing. During the following 35 years he made patent applications for nine other inventions, including a centrifugal motor, a multi-radial wheel and a mechanical propulsion device. He was obsessed with discovering the secret of perpetual motion.

Influenced by the classics and by his research into Egyptology at the South Australian Museum, Unaipon studied Aboriginal mythology. In the 1920s he compiled his versions of legends, published in the *Sydney Daily Telegraph* beginning on 2 August 1924. William Ramsay Smith published them, without acknowledgment, as *Myths and Legends of the Australian Aboriginals* (London, 1930). Unaipon published poetry in the 1930s and more legends in the 1960s.

During his long life, Unaipon travelled throughout southeastern Australia, urging the need for better conditions for Indigenous people. The best-known Indigenous Australian in the 1920s, he became his people's spokesman and appeared before two Royal Commissions into the treatment of the First Australians. Unaipon was a preacher, and he gave lectures and sermons in churches and cathedrals of different denominations. He also spoke at schools and to learned societies on Aboriginal legends and customs. He was still preaching at 87.

David Unaipon has been immortalised on the Australian $50 note.

In his 90s Unaipon worked on his inventions at Point McLeay, convinced that he was close to discovering the secret of perpetual motion. He died aged 94 on 7 February 1967. ■

- Visit the *Australian Dictionary of Biography* online at adb.anu.edu.au to read David Unaipon's biography as well as those of 163 other Indigenous Australians.

word watch

The Australian National Dictionary Centre is a joint venture between Oxford University Press and ANU. In his last column for *ANU Reporter*, Director **BRUCE MOORE** gets waggy, woolly and dorky with the word dag.

In spite of American imports such as dork, dweeb, geek, and nerd, Australian English dag continues to hold its own. It means 'an unfashionable or socially awkward adolescent' and, more generally, 'any unfashionable or non-stylish person'. This Australian dag has been around since the 1970s, but it was preceded by two other dags.

First, there was the dag associated with sheep: 'a lump of matted wool, faeces, and dirt hanging from the rear end of a sheep; such a lump cut from a sheep.' This 'sheep' sense of dag came to Australia from British dialect, where its common form was daglocks. In the abbreviated form dag it has been part of Australian English since the 1870s. Secondly, during the First World War another Australian dag appeared: 'a person (primarily male) who is regarded as something of a 'character', eccentric but entertainingly so'. Initially it looks as if this dag might be a variant of wag 'a joker', but it is more likely to have its origin in another British dialect word dag meaning 'a dare, a challenge, a feat of skill'. In British dialect, a dag was a person who had a dag or 'a shot' at something, and the Australian dag who is a bit of a wag seems to have developed out of the dialect daredevil.

How, then, do these two dags (the sheep dag and the wag dag) relate to our dorky contemporary dag? While the daredevil dag is an entertaining character, he is also perilously close to being a fool and a bit of a dolt, and such a shift of perception was the primary means by which the waggy dag developed into the current sense of the dorky dag. It is likely, however, that the negative associations of this new dag were also influenced by the sheep dag. The clue to what is going on here is evident in the development of the senses of the associated adjective daggy. Daggy in the sheep sense meant 'fouled with dags', and this sense existed from the end of the nineteenth century. In the 1960s and 1970s a new sense of daggy emerged, illustrated by these passages: (1967) 'Daggy, to be dirty. Same as warby and scungy.' (1972) 'Daggy is associated often with hairiness, untidiness, disintegration, bodily dirt and waste matter, as in: "She's married to a daggy artist in daggy jeans in a daggy Paddo flat".' (1974) 'I now also dress by preference in 'pre-worn' clothing some of which, in normal likelihoods, might be a bit daggy.' The development

from daggy meaning 'dirty and unkempt' to 'unfashionable' is fairly clear-cut here, and there is no doubt that the end of this daggy's journey is the unfashionable or dorky adolescent or dad.

It seems likely, therefore, that while the three dags have separate strands of development, the waggy dag turned into the nerdy dag, and there has been some influence of the sheep dag on all senses of daggy and no doubt also on the dorky and nerdish sense of dag. ■

Still life, beating heart

The work of south coast artist Cobi Cockburn graces collections around the world, and now the ANU alumna has had an entire exhibition purchased by a leading gallery. By **MARTYN PEARCE**.

South coast artist Cobi Cockburn with a piece of her art which has been acquired by the National Gallery. *PHOTO BY GREG PIPER.*

Glass art is, in some ways, as far from the natural world as you can get. It has been shaped, moulded, blown and bashed by human hands into a form that is anything but natural.

But for Cobi Cockburn – a rising star of the art world and a graduate of the ANU School of Art – art can be a way to bring the natural world to life, and glass is just one of the mediums she uses to do that. Her works, many of which highlight the natural lines and contours of the environment, bring the vibrancy and the beating heart of the Australian landscape into abstract life in the often clinical confines of studio and exhibition spaces.

It's an artistic style that has caught the eye of galleries and art collectors worldwide. Her recent exhibition, *'Esse, being in the abstract…'* was purchased in its entirety by the Art Gallery of Western Australia (AGWA). It was a rare large purchase of a single artist's work, and one that allowed the nine glass panels that made up the exhibition to stay together forever.

After 18 months of working on the pieces it was a relief to the south coast-based artist.

"The panels were created in a specific order for placement in the gallery with the intention of forming a cohesive body of work," she says.

"It was also about changing the emotive power of a space; altering an empty room to channel a personal journey and attempting an understanding of both a physical and spiritual landscape.

"To keep these works together was of great importance, yet I thought so far out of reach. So far, in fact, that I thought I would be the only one who would have the time to absorb the whole 'story', and after that it was a matter of them being 'individual moments'.

"So when I was informed of the AGWA… I was really taken aback and quite speechless. It enabled this body of work that I had always dreamt of as a whole to remain together, and for me that was fitting and rewarding."

The purchase of the pieces is but the latest step in the growing recognition of her work, and it's unlikely to be her last. After graduating with a Bachelor of Visual Arts from the Sydney College of Arts in 2001 she went on to a string of residencies and teaching posts, before coming to ANU in 2006 to do an honours degree. The awards started flowing in the same year, with the 2006 Ranamok Glass Prize, followed by the Talente Prize for Glass the following year. Her glass art now forms parts of collections around the world, including at The Corning Museum of Glass in New York.

Her work also found a fan in former ANU Vice-Chancellor Professor Ian Chubb, now Australia's Chief Scientist. To mark his retirement from the University, he was presented with one of her works.

The piece made for the former Vice-Chancellor was a rare example of Cockburn's work being made on request. In general, she says, she makes her work for herself, and to connect with the world around her.

"I try and maintain an honest and contemplative relationship with my art: one that allows the idea to drive the work," she says.

"Aesthetic qualities are really important, but they're not everything; nor is immediate access. My aim is to divine the way through the elements of a world that I do not fully understand, and the results represent the deep questioning that takes place during their creation.

"I create work for myself. However, at the end of the day if I can create a work that others respond to, then that is an amazing feeling and a feeling that compliments and rewards the entire process.

"It's an addiction I enjoy, but don't totally understand," she says. ■

The nine pieces that make up Cobi Cockburn's recent exhibition, *'Esse, being in the abstract…'*

Professor Brian Schmidt. *PHOTO BY BELINDA PRATTEN.*

A Nobel endeavour

From the vineyard to the classroom, Professor Brian Schmidt has had a life of success, and now he has the Nobel Prize to show for it. By **MARTYN PEARCE**.

The call came in at 8.30pm. On the other end of the line was a woman with "an impeccable Swedish accent". She asked if the man she was speaking to was Brian Schmidt.

Professor Brian Schmidt, astronomer, physicist and vigneron, told her that, yes, it was he.

"Are you sure?" said the woman.

"This is a very important phone call from Sweden."

In that instant, Schmidt realised just how important.

Within a few moments the academic from the University's Research School of Astronomy and Astrophysics was talking to the entire Nobel Prize Committee. They told him that he had won the Nobel Prize for Physics, and asked him to face the world's media by phone at the announcement, which was just minutes away.

Schmidt, part of a team that completely changed our understanding of the universe, is characteristically good humoured about the moment his own life completely changed.

"They call you up just before the award ceremony," he says. "The whole prize committee congratulated me, asked me how my wine vintage was going and whether in seven or eight minutes I would be able to go live with the press conference and tell the world my reaction.

"It was quite exciting, that's for sure."

It was also an amazing achievement. At just 44, Schmidt becomes one of only 12 Australians to take one of the coveted prizes, and the sixth associated with ANU. That he is still – by academic standards – a young man, with a lengthy career ahead of him, makes the award all the more remarkable.

> "I wanted to do a big experiment. I always think that you want to do experiments you can explain to your kids or your grandmother."

So where did this star of the stellar systems begin his journey? It turns out that in Missoula, Montana, where he was born and raised, the Schmidt family put science in his veins.

"I grew up in a family that had a lot of science. My father was a biologist, so science was just something I grew up with. I remember him starting and finishing his PhD – I was six at the time. My mum had a job, so I'd go out into the field with my dad and help him with his science experiments. Science was always something I found enjoyable," he says.

Although astronomy was "never an obsession", his parents had the smarts to recognise his interest in the stars, buying him a subscription to an astronomy magazine and an inexpensive telescope so that he could see the moons of Jupiter.

While no academic slouch, Schmidt says that he wasn't the stereotypical high school boy genius. Instead, he performed well and got his astronomy fix from a limited exposure in the physics curriculum. His enjoyment of astronomy not withstanding, he never saw it as a future job.

"I didn't mind going out and trying it, but I was pragmatic and figured that even if I studied astronomy, I probably wouldn't have that good a chance to do it as a career," he says.

Despite his career reservations, he was able to use his undergraduate studies at the University of Arizona in Tucson to focus on his passion, although even then he hedged his bets on whether there was a future for him in astronomy.

"I wasn't very happy at university – I just struggled a bit with the situation. So I spent a lot of time doing classes and ended up doing two degrees at the same time – physics and astronomy."

That dedication paved the way for Schmidt to get into Harvard University where he did his PhD. His thesis at the Ivy League institution looked at Type II Supernovae systems, marking the start of a career looking at the exploding stars.

In 1994, a year after completing his PhD, a fresh-faced Schmidt arrived at ANU. He was lured, he says, by the chance to be involved in research that would be memorable.

"I wanted to do a big experiment. I always think that you want to do experiments you can explain to your kids or your grandmother," he says.

"My desire was to go out and measure the ultimate fate of the universe. It seemed like a pretty big question."

Working with Dr Adam Reiss of Johns Hopkins University, Schmidt led a team of 20 looking at that big question. The team aimed to use light from a supernova so distant that it had taken billions of years to reach us, to work out how much the universe was slowing down over time.

The results, however, were not what they expected.

"When we got our results in 1998 we found the universe wasn't slowing down at all, in fact it was speeding up.

"When we first saw the results, I have to admit that I thought we had made a mistake. It just didn't make sense. It seemed too crazy to have 75 per cent of the universe be missing and be a certain type of matter that pushes on itself.

"It turns out that's all allowed by general relativity, and Einstein even invented this stuff, but it's certainly a pretty big leap to go and tell the world, 'oh hey everyone, we've missed 75 per cent of the universe, the universe is speeding up and gravity is working in reverse'.

"I was very reluctant to tell everyone, but I knew we had to. That's the way science works. You don't want to prejudge the universe; the universe does what it does, our job is to measure it."

But Schmidt's trepidation was unfounded. His team's research – and that of joint Nobel Prize winner Professor Saul Perlmutter – met a largely receptive audience, and in turn helped solve a few cosmic conundrums.

"I was surprised because there seemed quite reasonable acceptance, quite quickly," he says. "Part of that was because the announcement was made by two teams who were working fairly combatively with each other. The other thing is there were

some problems in cosmology, and this stuff we found fixed most of the outstanding problems, so it was sort of like people said 'okay, this may be right – it's not obviously wrong'."

While his discovery changed not only the world, but the universe, Schmidt got quietly on with the astronomical research he loves. As his career developed at Mount Stromlo, he built a life for himself at Canberra, a place he says he has "no intention of leaving", and established a vineyard just outside Canberra where he makes pinot noir – a notoriously temperamental drop, and one befitting someone who is able to understand the complexities of astrophysics.

Like so many Canberrans, Schmidt was deeply affected by the bushfires of 2003. But the flames that engulfed Mount Stromlo did more than just destroy his office; they also fundamentally affected his research. Schmidt was just about to start a project using Stromlo's 50-inch telescope to map the southern skies. But that telescope, like others at Stromlo, was destroyed.

But, out of the disaster came rebirth – in the form of the SkyMapper telescope, the project that has occupied Schmidt for the last few years.

Located at the University's Siding Spring Observatory, in the New South Wales countryside, SkyMapper is a state of the art instrument that will allow for the first ever complete map of the southern skies.

"[SkyMapper] has the ability to take a picture of the sky 40 times bigger than the full moon, 10 million times fainter than the human eye can see," he says.

"Over the next five years a team from Stromlo and I will be mapping the entire southern sky 36 times in six different colours, to make a sort of treasure map of the sky.

"With that we can get big telescopes like the Giant Magellan Telescope, or the Hubble Space telescope, to study things like the outer solar system, or other planets like Pluto, or to find the most distant object in the universe like giant black holes that were formed after the big bang."

The University's investment in both SkyMapper and the Giant Magellan Telescope to be constructed in Chile – another project Schmidt is heavily involved in – continue a long history of Australian support for astronomy. It was, says Schmidt, part of the reason he was drawn to the country in the first place.

"Around the world in astronomical circles Australia's reputation is well-known," he says.

"One of the reasons why I came here is because ANU and Mount Stromlo has a great reputation that goes back 50 years. Australia has invested heavily in astronomical instrumentation since about 1940, and that has enabled a critical mass of people to get together in this country and do a whole range of discovery over the last 50 years."

Those discoveries, and the life of discovery that comes with a career in academia, are things that Schmidt is keen to share and encourage in others. Winning the Nobel Prize, he says, means that he now has a welcome obligation to science and the public.

"It changes my responsibility to the scientific community in Australia. I have, I think, a real responsibility to ensure that Australia does wise things in science and technology in the future.

"I guess I should also be explaining to people that it's not hard to win a Nobel Prize because, look, even I can do it!

"People like me in science have great careers here in Australia; it's a very good thing to do with one's life. I have no regrets, and I'm kind of a normal person by most people's count. I really want to get it through to Australians, and especially young Australians, that science is fun, a great job, and you never know where it's going to lead to."

And like the accelerating universe his research heralded, the science of astronomy itself is at the dawn of an exciting and rapidly unfolding future.

"I've been lucky to be born at the right time," he says. "There has been about 10 years where the technology has really allowed discovery to blossom. I see that happening for the next 20 or 30 years, at least, so I think it's a very special time for astronomy."

And that's something we can all raise a glass of pinot to. ■

What he found, and what it means

The formal citation for the 2011 Nobel Prize for Physics is "for the discovery of the accelerating expansion of the universe through observations of distant supernovae".

Astronomers have known since the 1930s that the universe is expanding, with almost all galaxies moving away from our Milky Way. The discovery of the cosmic microwave background radiation in the 1960s confirmed the Big Bang theory for the origin of that expansion.

However, it was expected that the rate of expansion would slow down over time due to the effect of gravity drawing all the matter in the universe together.

One way to test this is to measure how the rate of expansion changes over the course of cosmic history. The exploding stars called type IA supernovae are approximately all the same intrinsic brightness, so by comparing the apparent brightnesses of supernovae in progressively more distant galaxies it is possible to track the change in the rate of expansion.

This very challenging program was carried out by the two international teams of astronomers led by Perlmutter and Schmidt and Riess.

Their shocking discovery was that, rather than slowing down, the expansion was speeding up. This accelerating expansion suggests that there is a previously unknown constituent of the universe that counteracts the effects of gravity. This result has subsequently been confirmed independently by other methods. Now understanding this so-called 'dark energy' is one of the most important goals in modern physics, and astronomers are racing to unravel the mystery.

– BY MATTHEW COLLESS, DIRECTOR, AUSTRALIAN ASTRONOMICAL OBSERVATORY

Professor Brian Schmidt met with Prime Minister Julia Gillard on the day after the announcement. *PHOTO BY LEANNE O'ROURKES.*

The astronomer is mobbed at a celebration to honour his award at University House. *PHOTO BY DARREN BOYD.*

A stargazer becomes a star

If you Google Brian P Schmidt, more than two million search results come up. It's hardly surprising. After all, he's helped to overturn our understanding of the universe. Now, with a Nobel Prize under his belt, it's not just the Internet which is abuzz with his name. Worldwide newspapers, radio, TV, Facebook and Twitter are awash with tributes to the astrophysicist and winemaker.

A congratulations call from the White House came soon after the award, as did a meeting with Australia's Prime Minister, who said Schmidt's win was an award which would make all Australians proud.

"It is not very often that you are looking for words of congratulations for someone who has literally redefined our understanding of the universe," Ms Gillard told parliament. "But that is exactly what Professor Schmidt has achieved. This discovery turned some of our most stable notions of the universe on its head and challenges our understanding of its very composition.

"This is a fantastic personal award for him, but when I met with him the thing he wanted me to most understand was he viewed it as an award for the team of researchers that he worked with. He is very proud of the work that he does. He is very proud of the team of researchers that he works with."

The Leader of the Opposition Tony Abbott added his praise to the Prime Minister's.

"In a stellar career the Nobel Prize is the ultimate accolade. This is obviously a great moment for our country. It is a great moment for his university and for Australian science."

The win has also attracted wide-spread praise from the field of science. Professor Suzanne Cory, President of the Australian Academy of Science, said Schmidt's work has had a profound and immediate effect on cosmology.

"The finding has completely altered our understanding of the universe and opened up important new fields in the study of time and dark energy," she said.

Director of the Australian Astronomical Observatory, Professor Matthew Colless said that Schmidt's breakthrough was a "revolutionary piece of work".

"Brian is not only an excellent scientist but has also been active in shaping the direction of the Australian astronomical community," he said.

But what does the man currently at the centre of the universe think about it all? If you follow his Twitter feed, @cosmicpinot, you'll quickly see it hasn't all gone to his head.

"What a day!" he tweeted the day after he won his award. "Haven't had time to tweet! Thanks to everyone for their support, & especially the High-Z team – 20 people who made this happen."

And after the media scrum had backed off a little, Schmidt had time to reflect on his amazing achievement and let it all sink in.

"So I have woken up today to find that I am yesterday's news," he told his followers on Twitter. "Which may sound bad, but I assure you, is bliss." ■

– BY JAMES GIGGACHER.

Meeting of the minds

Professor Brian Schmidt's Nobel Prize win was the 12th for Australia and the first time in almost 100 years that an Australian has won the award for physics. It was also the sixth time a researcher with close connections to ANU has won the prestigious Swedish award.

Lord Howard Florey

1945 Nobel Prize in Physiology or Medicine

For the discovery of penicillin and its curative effects in various infectious diseases (shared with Ernst Chain and Alexander Fleming).

Lord Florey was an early academic adviser to ANU and Chancellor from 1965 to 1968.

Professor John Eccles

1963 Nobel Prize in Physiology or Medicine

For pioneering work on the brain and central nervous system which reshaped science's understanding of neurological processes.

Professor Eccles was founding professor of physiology at The John Curtin School of Medical Research at ANU.

Professor John C Harsanyi

1994 Nobel Prize in Economic Sciences

For pioneering work on game theory and developing a new tool for economic analysis (shared with John F Nash Jr and Reinhard Selten).

Professor Harsanyi taught economics at ANU from 1958 to 1961, completing some of his early research on game theory while at the University.

Professor Rolf Zinkernal and Professor Peter Doherty

1996 Nobel Prize in Physiology or Medicine

For their revolutionary work in immunology.

Professors Zinkernagel and Doherty first met and worked together at The John Curtin School of Medical Research at ANU.

Telling rural tales

The tough farming conditions of the Monaro have inspired a documentary, and an unusual collection, writes **MARTYN PEARCE**.

The barren and harsh landscapes of the Monaro's farmland may be one of Canberra's nearest rural neighbours, but in many ways the area is so different it may as well be the surface of the moon.

The bitterly cold, treeless plains and towering inhospitable alpine mountain ranges are historically and notoriously hard landscapes to live on and to farm. They are landscapes which attract only the most dedicated, or crazy, or both.

They are also landscapes that ANU honours student Laura Clarke knows only too well. Clarke, who is coming to the end of a New Media Arts degree, grew up in the town of Nimmitabel, near Cooma. Her family have farmed that harsh land for more than 50 years. Over time, her family like so many others on the Monaro, have become part of the rich tapestry of lives and stories of the area.

They are stories that Clarke wants to tell.

"I've always had a fascination about the portrayal of rural life," she says. "And for my honours project, I was interested in pursuing the idea of rural life and how we film that and capture that way of living."

Her project turned into a 10-minute documentary. Self-shot with two cameras and occasional help from her mum ("she helped me out with the sound, holding the external microphone") the documentary shows a story of a typical rural farmer, with a very unusual hobby.

"My farmer, Bill Shanley, is a quirky character. He collects tractors – he has about 100 in all. He's a bit obsessed about these tractors and doing them up.

"About a year ago he bought his first computer and taught himself how to use eBay. Since then he's spent thousands getting John Deere tractors exported from America. It's quite a big deal, even *The Collectors* has done a segment on him."

But while Shanley's extensive collection may provide some light moments, the documentary attempts to highlight some of the challenges farmers face for the future.

"His family moved to the area in the 1870s and set up in (Old) Adaminaby. They had the farm for many years until the building of the Eucumbene Dam forced them to move. So at the age of eight he and his family moved to a property north of Cooma.

"In the film he makes the point that it's been a good way of life, but he'll probably have to sell the place because he only has daughters. It gives you the sense that if you're a farmer (and whether you have sons or daughters) if no one wants to inherit the space then it's just kind of lost."

Before she started work on the film, Clarke viewed "more than 100" rural documentaries. Getting a taste for how directors tell rural stories, the devices they use and way their characters are portrayed. Her homework left her wanting to make something simple in essence, that portrayed the farming life she knew.

And it's a life that many who haven't grown up on the land, would, at times, find confronting.

"In one portion of the film he finds a ewe that's down. It's had a lamb but it's dead and it's eyes have been pecked out by the crows. Bill talks about how horrible crows are and you really get that sense of the brutality of farming life," she says.

Another issue that farmers have to face – and perhaps one of the reasons why their children are less keen to follow in the family footsteps – is that however beautiful, or productive, or well-tended your farm, it's a place that's very hard to get away from.

"When you're a farmer you don't really escape at all," says Clarke. "You can't leave your work behind.

"You can get used to seeing that cycle of death and life, but the fact that you don't leave the farm at night is part of the reason that it makes it such a hard job, as well as one of the reasons people have such incredible ties to the land."

This gradual loss of farming families, and with it the rich history of their stories, is something Clarke says she has a sense of in both her hometown and from her research.

"I think a lot of rural communities aren't all that sustainable. Small country towns are dwindling. Things are tough and people are selling up.

"At the Australia 2020 summit one of the first questions posed in the Future of Rural and Regional Australia stream was 'who will the future generation of farmers be?' I think in many ways that's the question my film is also attempting to pose," she says.

The budding filmmaker hopes to one day return to a life on the land, but for now it's the call of creativity and the silver screen that's louder than the rumble of a diesel tractor engine or the bleat of a new-born lamb. And in her absence, those tough, sometimes crazy, characters will keep calling the Monaro home.

"[Bill Shanley's] very matter of fact about it, saying there's been some rough times but at least you're your own boss. On the Monaro you get a lot of kicks, but you get back up and get on with it." ■

- Bill Shanley's segment on ABC television's *The Collectors* can be seen at bit.ly/rep_collectors

Laura Clarke. *PHOTO BY BELINDA PRATTEN.*

Taking maths to the masses

PhD student Lashi Bandara is on a one-man mission to make maths accessible. By **TEGAN DOLSTRA**.

"He walked into the first lecture, coffee stains all over him, long white hair, red socks with thongs, and wrote $\sqrt{2}$ on the blackboard. Then he said, 'This entire semester will be spent understanding this guy. If I see anyone using one of these…' and he pulled out a calculator and smashed it to smithereens. That was one of the turning points – when I realised 'wow, this is going to be great'."

Lashi Bandara doesn't need caffeine to bolster his enthusiasm for pure mathematics; he sips a decaf cappuccino as he recreates his first encounter with ANU mathematics graduate Marty Ross.

Now an ANU PhD student under Alan McIntosh and a recent Fulbright scholarship awardee, Bandara just can't get enough maths.

"I do it when I fly, when I'm on the loo, I do it at the pub – everywhere. The laboratory of mathematics is always with me, always in my head," he says.

It seems Bandara is making up for lost time.

"It was a pretty long trip to find mathematics. I really disliked maths at school," he says.

"Incredibly turned off" by high school maths, Bandara began uni in the realms of performing arts, philosophy and computer science.

His passion for pure maths wasn't ignited until much later, a result of inspirational lecturers such as Ross and "a string of good luck".

Bandara is not shy in his opinion of the way mathematics is taught in schools. He believes the entire curriculum is due for an overhaul.

"The way we are taught mathematics in schools is potentially quite damaging," he says. "It doesn't allow kids to develop creativity, ask questions or really understand what's going on – it's just a bunch of methodologies. Repetition may be an effective way to learn, but it really only hones a specific set of skills.

"As Einstein said: 'Any fool can know; the point is to understand.' And I think that gets very much lost in the current school system."

In a bid to make maths fun and accessible for students, Bandara became involved in the national Mathematicians in Schools program. He conducted a course at Hawker College where one of the aims was to demonstrate that 1 is less than 2.

"It isn't hard but it is non-trivial because we need to construct a notion of a number," he says. "We all know that 1 is less than 2, but that's often how it is with mathematics – you may feel that something is true, but one needs to think rigorously in order to prove it."

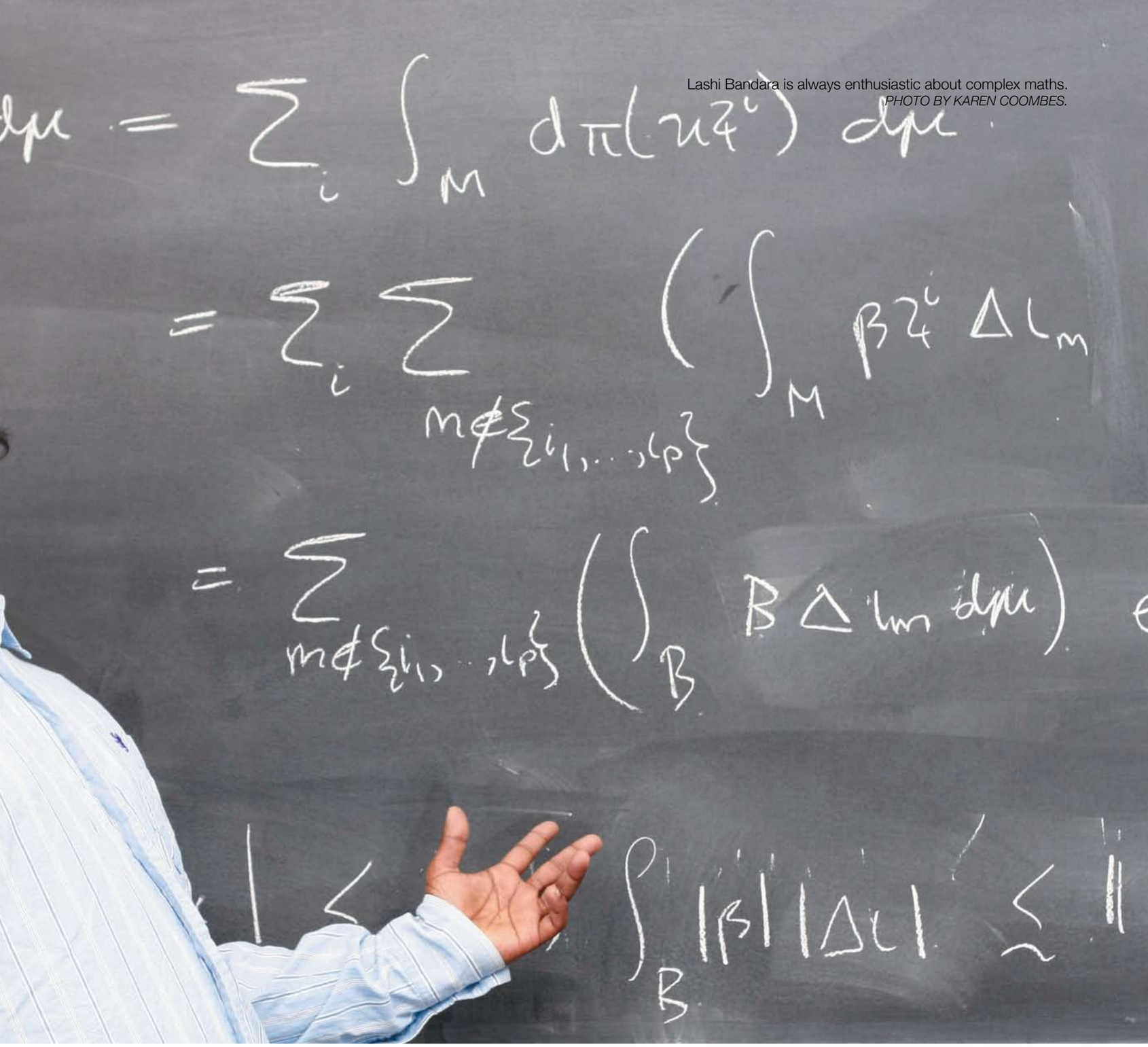
People often take pure mathematics for granted, dismissing it as abstract and irrelevant to everyday life says Bandara.

"You'd be surprised where pure mathematics pops up. It's everywhere, but you don't necessarily see it because you're not really looking for it."

One of the most powerful examples of the impact pure maths has had on the world is the advent of the computer, says Bandara.

"The notion of the Von Neumann architecture that is the basis of computers today came from Alan Turing trying to answer David Hilbert's 'decision problem'.

"It's an abstract question, which Turing was trying to answer purely for the sake of the question itself. Yet it's given birth to one of the most powerful concepts we know today."



Lashi Bandara is always enthusiastic about complex maths.
PHOTO BY KAREN COOMBES.

> I do it when I fly, when I'm on the loo, I do it at the pub – everywhere. The laboratory of mathematics is always with me, always in my head.

Bandara emphasises that most of the real-world applications of pure mathematics are unforseen. Such as when two mathematicians in the United States unwittingly solved a long-standing problem in astrophysics.

"These guys had no idea they'd solved it," says Bandara. "It was only when they got a congratulatory email from a mathematical physicist that they realised they had settled Sun Hong Rhie's 'conjecture on gravitational lensing'.

"That's the way mathematics works – it eventually becomes useful, but it can take a long time for technology to catch up to the ideas. Alan Turing had the idea behind the computer in 1937, but vacuum tubes had to be improved before people could start building computers."

Bandara is off to the University of Missouri then Stanford next month to commence his Fulbright scholarship. He has plans to take horse riding lessons, buy a Harley Davidson and ride across the Arizona desert.

But he has to be back in Australia by November next year to pursue another of his passions – photographing solar eclipses.

"My first eclipse, in 2002, lasted 26.5 seconds," he says enthusiastically. "It really affected me. I bought myself a new camera, and started practising for the next one. Cairns next year will be my fourth."

Bandara's pursuit of eclipses has taken him to Lyndhurst, South Australia, the Libyan Plateau, Egypt and Hangzhou, China. And as he heads to the United States, there is no doubt that he will take maths with him wherever he goes.

"I really don't know exactly how [my research] will apply to reality, but I'm motivated by what I feel are beautiful questions and I enjoy spending many hours a day thinking about them." ■

Frank Bowden. *PHOTO BY BELINDA PRATTEN.*

The bugs that shape history

Frank Bowden's recent book, *Gone Viral*, details how infectious diseases have shaped humanity and changed the world as much as wars, major inventions and significant people. By **LEANNE O'ROURKES**.

Try not to scratch, but bugs are everywhere. Invisible to the naked eye, miniscule life forms inhabit every nook and cranny of the planet, including inside our own bodies.

Each of us supports a unique micro-world that is home to countless individuals. The inhabitants are much like the animals and plants that feed off the Earth, but instead the Earth is you. If you put yourself under the microscope, you would find something in the realm of 90 trillion microbes inside you. And every one of these miniscule beings has its own job that could help or destroy you.

While the habits of the microscopic organisms inside us are fascinating, infectious diseases doctor Frank Bowden from the ANU Medical School is more interested in the habits of people in relation to them.

"What has always been more interesting to me is what the bugs do to humans and the human's experience," says Bowden. "The more you learn, the more the disease in the human becomes less interesting than the human in the disease.

"Germs make us sick but how we deal with that, and how our doctors deal with their patients as human beings to me is central."

Central too is the way that people treat each other when infectious disease strikes, a theme that has sparked an epidemic of big-budget feature films that explore human-disease relationships like *Outbreak*, *28 Days Later* and Hollywood's latest offering, *Contagion*. Pandemic possibilities are particularly remarkable because of their global potential. Unlike many debilitating infectious diseases, they still affect the world's rich inhabitants.

"After the first human cases of bird flu were detected in Hong Kong in 1997, the public health world started getting serious about the development of an influenza pandemic plan," says Bowden. "And then in 2003 this strange disease Severe Acute Respiratory Syndrome (SARS) came along and it was worse than any flu had ever been.

"People have a memory of the 1918 Spanish Flu which is regarded as the worst epidemic in history. The estimate is that two-and-a-half per cent of the world's population died as a result, and the death rate was about four per cent.

"If you looked at SARS, the death rate was about 10-12 per cent. And it was caused by a virus that no one had seen cause human disease before, so there was no vaccine and no antiviral treatment. We had no idea how far it was going to spread but it was clearly disseminating rapidly across the world because of air transport."

But after causing 774 deaths in 11 countries, something happened to SARS. Within months of emerging, the disease disappeared, and it happened in the absence of treatment or a vaccine. Bowden says this phenomenon was extraordinary.

"Here's the fascinating thing," he says. "It behaved in a way unlike influenza viruses, where you're usually infectious from the moment you get sick.

"With SARS you get really sick quite quickly but your infectiousness doesn't peak until a week to 10 days after the onset of symptoms. So what that means is that if you quarantine people you can control the disease. Once this was realised, the victory over SARS was a pure triumph of infection control."

There are, however, problems within these solutions. People see success stories like SARS and complacency spreads like a virus through the population. They think the flu epidemic can be controlled in the same way but it can't because the biology is different.

"For the flu, infectiousness is high almost as soon as you become sick, so quarantine has a much smaller effect on the epidemic," says Bowden.

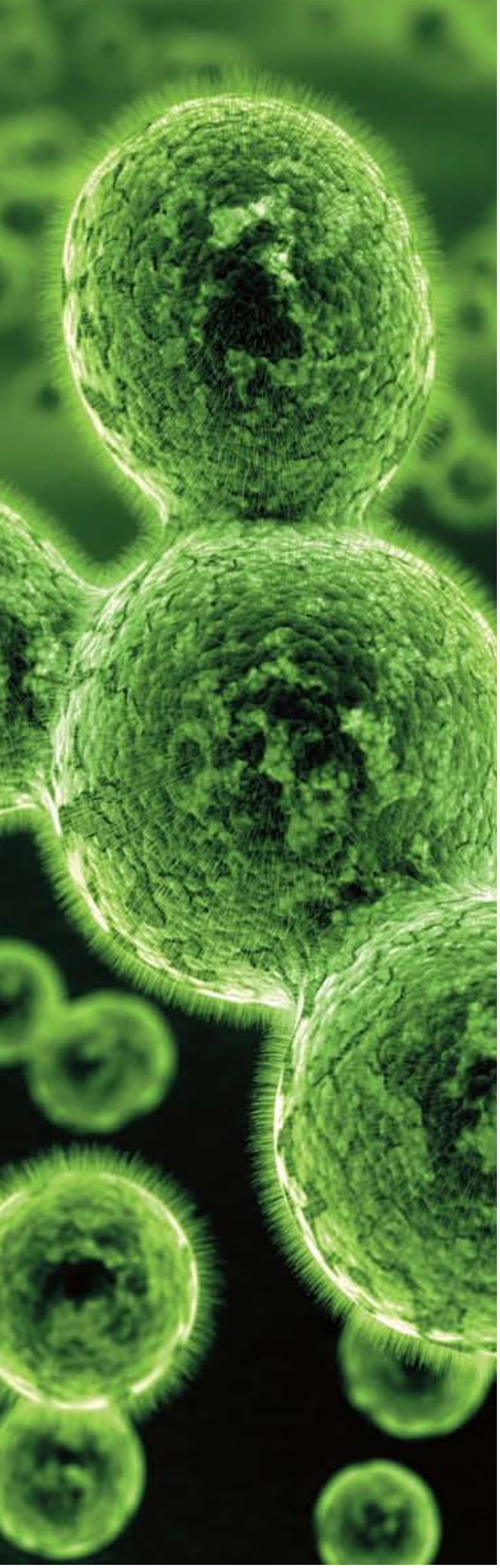
"In addition, you have to produce a new vaccine every year because the virus mutates: the antigens on the surface which are responsible for the immune response change, or drift slowly, but occasionally a major change or shift occurs and a virus emerges that the population may have no resistance to.

"That's what happened with the swine flu of 2009 – most of the population under 60 had no immunity. But what it didn't do, which saved millions of people's lives, was that it didn't mutate into a virulent form. It was highly contagious but not very deadly.

"On the other hand, the bird flu is highly virulent, with a death rate of up to 60 per cent, but it's hardly contagious for humans.

"So here's the nightmare scenario," warns Bowden. "If the avian influenza virus recombines with a human influenza strain, and if it takes the components which make the strain transmissible from human to human and also takes the bird flu virulence, then you've got a potential for disaster."

The good news is that researchers are making progress towards a vaccine that works on the common core of the influenza molecule, which means that it could be effective for all strains



> The more you learn, the more the disease in the human becomes less interesting than the human in the disease.

of the virus and could avoid the need for a new vaccine each year.

"After vaccines, one of the best weapons we have against bacterial infection is antibiotics, and people don't always know that the original, penicillin, was derived from a fungus," reflects Bowden. "There were other synthetic drugs that had antibacterial activity before it but the difference was that penicillin was a much safer drug.

"But even then penicillin was only effective against certain bacteria. For example, the commonest cause of urinary tract infections, the *E.coli* that live in your gut, were resistant to it from the start.

"So they needed to look for more naturally occurring fungi in the wild. With the development of organic chemistry in the mid 20th century, the ability to manufacture and modify molecules increased exponentially so that now many antibiotics are synthesised in the laboratory.

"Nevertheless, looking to nature is still an extremely fertile area for exploration, which is one of the reasons why we should be worried about the loss of biodiversity. Probably as we speak, organisms that may hold cures for all sorts of things are going extinct."

Perhaps the greatest achievement in infectious disease since 1960 is the development of antiretroviral drugs used for treatment of HIV, a discovery that has saved millions of lives and one that Bowden feels privileged to have lived through.

"It's magical almost," he smiles. "It was the new penicillin, you know. With the advent of antivirals, I lived through another penicillin era, something I had always wanted to do.

"The big year for HIV was 1996. If only Freddie Mercury could have lasted until combination therapy was available, we would still be going to Queen concerts. But it was a great tragedy for him and for millions of others who died before the drugs were developed."

While the magnitude of societal benefits as a result of such advancements is unsurpassed, many people in the developing world are still dying. Bowden believes humankind's greatest medical failing has been to the billions who are vulnerable to infectious diseases in the impoverished world.

"In the 1970s, Australia's Nobel Prize-winning immunologist and virologist, Frank MacFarlane Burnett, was writing that the fight against infectious diseases was all over," says Bowden. "He was right, in the sense that in the developed world tuberculosis and other bacteria infections were treatable and people weren't dying from vaccine-preventable childhood illnesses.

"But as well as failing to allow for the emergence of new diseases such as HIV or hepatitis C, his comments ignored the developing world.

"Companies, understandably, want to develop vaccines that are going to make a profit. For example, there has been no new vaccine developed for 100 years for tuberculosis, a disease that is rare in the developed world, but extremely common in the developing world.

"HIV treatment is a miracle of modern medicine – if you can afford it.

"Even in Australia there are some diseases that don't get public attention and which most people would never have heard of, and yet the effect that they can have upon Aboriginal people, who are the disadvantaged population within our rich nation, is huge."

Fortunately, philanthropists like Bill Gates and Warren Buffet, and organisations such as the WHO and the UN are making sure the cries of the underprivileged are heard. Millions of people are now on subsidised HIV treatments as a result of deals struck with pharmaceutical companies to provide two different pricing tiers for their rich and poor customers.

"The Melinda and Bill Gates Foundation has focused on HIV, tuberculosis and malaria. And by doing that they've changed the world because conditions that you and I don't think about have finally become the focus of research again," says Bowden.

"It's the hundreds of millions of people who are affected by these diseases who need advocates. They need people to work on it because, in the absence of a profit motive, pharmaceutical companies won't." ■

John Morgan and Benton Maxted. *PHOTO BY JAMES GIGGACHER.*

A human touch

Undergraduate students are engineering solutions to provide humanitarian assistance in the developing world, writes **JAMES GIGGACHER**.

It may not seem so at first glance, but the machines, buildings and technology of our world beat with a human heart. From the wires of a computer, to the surface of a skyscraper or the dial tone of your phone, these creations are just some of the many ways that our lives and world have been improved by engineers – innovators who use their minds and hands to transform nature's resources into real benefits for humanity.

ANU undergraduate students are also using engineering to make a real difference in people's lives. As part of the humanitarian engineering program in the ANU College of Engineering and Computer Science they are working on two projects to help improve living and working conditions in an Indian mining community. Based in Maharashtra in western India, the projects represent the joint efforts of ANU, Engineers Without Borders (EWB) and the Indian human rights organisation, Santulan.

One project has seen 21 fourth-year students design a sustainable school for children living in the disadvantaged mining community. Design project leader and honours student John Morgan says the school will help provide an education to 100 children who would not otherwise attend school at all.

"One of the primary motivations behind this project was the opportunity to work on a design that could make a real difference," says Morgan. "For this project we really wanted to present a cost-effective design that was simple to implement.

"The school's three buildings are designed using locally sourced materials and methods. In a departure from typical Indian design, roofs are pitched to facilitate water harvesting, natural lighting and ventilation. To keep the indoor temperature at comfortable levels, passive cooling features such as natural air conditioning have been used.

"Incorporation of several sustainable technologies also ensured that the school would have a minimal impact on its surrounds. We suggested solar panels with a battery back-up to power the school and the use of solar cookers to provide meals for the students.

"In this project the welfare of the students was of the utmost importance, as would be expected from a humanitarian project. This also makes sense from a purely engineering perspective as keeping the students healthy and happy means that they are more willing to stay in school."

A second project, undertaken by honours student Benton Maxted, aims to protect quarry workers from the dangers of breathing in fine dust particles at their worksites.

"In India workers in mines and quarries across the country are exposed to very high levels of dangerous dust, with little or no protection offered," explains Maxted.

"Silicosis, a disease similar to asbestosis which can be fatal, is a huge problem in such sites, as workers inhale huge quantities of very fine silica dust. Not only are the workers exposed to this hazard, but their families often live at the quarry sites with them and can be exposed to this dust as well.

"There is a great need for engineering solutions to the dust control issue. If a low-cost solution can be designed, it would have a massive impact on the lives of both workers and their families."

Maxted has been investigating the filtration properties of different fabrics to design cheap dust masks. The face masks will make sure dust that enters the air doesn't enter the workers' lungs.

"If I am able to find fabrics which have similar properties to commercial-quality dust masks, much cheaper alternatives would be able to be produced," says Maxted. "Not only will the workers be better protected from potentially life-threatening lung diseases, but there may be an opportunity for the development of micro-businesses to help disadvantaged people earn an income."

With students like Morgan and Maxted on the case one thing is certain – tomorrow's better world is already being built today. ■

Reading the bones

The discovery of an ancient cemetery full of headless skeletons and giant tortoises in Vanuatu is digging up the dirt on the life, death and eating habits of the Pacific's first settlers. By **JAMES GIGGACHER**.

Three thousand years ago something new washed up on the shores of the unspoilt islands dotting the blue expanse of the world's largest ocean. Where only waves had lapped, fresh footprints in the sand marked the arrival of the first people into the Pacific – the Lapita.

The Lapita had launched their long-distance canoes from the Bismarck archipelago near New Guinea, island-hopping to the Solomon Islands, Vanuatu and then as far east as New Caledonia, Fiji, Tonga and Samoa. Their seafaring adventure into the most remote part of the globe was one of the great movements in history. It was also the birth of many of the societies and cultures found across the Pacific Islands today.

These Oceanic ancestors may have come on the waves but now they are known to us through the earth. Their elaborate and highly decorative earthenware pottery has historically provided the most insight into their long-lost culture. But now the clay is telling us more. A ground-breaking archaeological find on the island of Efate, where Vanuatu's capital Port Vila is located, is shedding new light on the history and culture of the Lapita.

In late 2003 construction workers who were building a prawn farm outside Port Vila stumbled across a massive piece of Lapita pottery at a quarry. Archaeologists Professor Matthew Spriggs, from the ANU College of Arts and Social Sciences, and Dr Stuart Bedford, from the ANU College of Asia and the Pacific, were called in to do a salvage excavation of the site.

"There were human bones and bits of pottery lying all over the place – it was a complete mess," says Spriggs. "So we weren't sure there would be anything there. Anyway we started digging and found out that luckily, much of the site was still there."

It turned out to be the earliest Lapita cemetery ever found. Up until the discovery only one other Lapita cemetery had been dug up, and that was in Papua New Guinea in the 1960s.

"So a second and a much older cemetery was really big news," says Spriggs. "We finished excavating the site in 2010 and we've now got something like 100 individuals all about 3,000 years old. It's increased the number of known Lapita burials across the Pacific by a factor of ten."

The site has given researchers incredible insight into the Lapita people's attitude to death and the afterlife, showing that the Lapita used their intricate pottery for elaborate burial rituals – often involving decapitation.

"We started finding complete Lapita pots with skulls inside them," says Spriggs.

"This Lapita pottery is very highly decorated and it's beautiful looking stuff. People have always figured that it must have some kind of ritual use when they found it. But most Lapita sites are settlement sites – village sites – so everything's mixed up and churned around. In the cemetery we have found complete pots – they're crushed, but all the pieces are there. And we think one of the rituals could have actually been breaking pots over burial sites, because the pieces don't move that far.

"In addition, all of the adult burials were headless. We did find some heads; there was one guy with three heads on his chest, but they weren't his

Above: Professor Matthew Spriggs. *PHOTO BY JAMES GIGGACHER.* Below: one of the decorated Lapita pots found in the cemetery. *PHOTO BY STUART BEDFORD.*

heads. The removal and keeping of the head in the house or some kind of shrine or temple is common in the Pacific, particularly island Melanesia. So this looks like it is a practice that is at least 3,000 years old.

"So we can see that the Lapita revered the heads of their ancestors. And what they did was dig pits which they put people in; they may have been wrapped in mats or something, but basically the bodies decomposed in the open air. When all the flesh had rotted away they removed the head and some other bones, sometimes the arm bones or the leg bones, and used them in some kind of ritual context or kept them somewhere else. So we've got a detailed knowledge now of these rituals which took place with the burial of people."

The cemetery is not just a window into the afterlife. It is also revealing some interesting things about what life before the hereafter was like for the Lapita.

"Using the bones and teeth found at the site we can now ask questions about these people which we couldn't ask before," says Spriggs. "Questions like who they were, what sort of diseases they had, what sort of injuries they suffered and what their health was like. The teeth are also giving us a taste of their diets. One main difference is that the men had a largely seafood diet while the women ate stuff from the land.

> "All of the adult burials were headless. We did find some heads; there was one guy with three heads on his chest, but they weren't his heads."

"And by analysing the minerals and sands found in the pots we have been able to identify where they come from. Some of the pots were actually manufactured in New Caledonia and traded to Vanuatu. We've also got some pots which we're not sure where they come from, but it could be as far away as New Guinea. They certainly don't come from Vanuatu. So we're finding out a lot about how these early settlers travelled. They're clearly very mobile and moving around all over the place.

"In the Lapita period, the whole of the western Pacific was very connected. People were zipping about in their canoes all over the place with their pots. And then quite quickly all that stops and you don't find these connections between different islands anymore."

The archaeological site has also thrown up something else we don't find anymore. Remains of long-extinct giant horned tortoises have been found in layers above the older human cemetery.

"There's the Lapita cemetery and starting about the same time there is some evidence of a little hamlet or small village," says Spriggs. "Over time it gets bigger and bigger and covers the cemetery, which partly explains how it was preserved, because the rubbish that people generated from the settlement built up and protected the skeletons underneath.

"What we found was in the earliest layers of the settlement, and in some cases within the cemetery itself, there were bones that we thought were just big sea turtles. One of the burials even had the shell from these supposed turtles placed over it. But, on closer inspection, we quickly realised that these weren't marine turtles at all – they were giant land tortoises. Not only that, they were giant land tortoises with horns. And this type of tortoise is extinct everywhere in the world today.

"Before this no-one had ever found the bones of these tortoises in association with humans. What we had was like a carpet of these things across the earliest layers of the site. The occupation levels of the site, the village, were like a carpet of these bones.

"And what we see is the actual moment of extinction on Vanuatu. Basically people turned up, there were all these giant tortoises wandering around and people just flipped them on their backs, killed them and then ate them. And they died out really quickly. These things were gone within two hundred years of people arriving in Vanuatu – they literally were eaten to extinction."

Even though the Lapita people and the giant tortoises which they had such a taste for are long gone, the recent discovery of their bones by Spriggs and Bedford means that they are no longer lost to history. Now, their connection with us today is set to get even stronger. Bedford has recently found two more Lapita cemeteries on other Vanuatu islands. This latest find promises to give a new lease of life to the extraordinary tale of a people who settled one of the last places on Earth to see humans – no bones about it. ■

Above: A complete skeleton shows what the long-extinct horned tortoises looked like. They once roamed freely on Vanuatu. *PHOTO BY C BENTO/ AUSTRALIAN MUSEUM.*

Left: A female skull found in one of the decorated pots buried at the cemetery site. Right: Frederique Valentin, the late Fidel Yoringmal and Jacques Bole working at the excavation site. *PHOTOS BY STUART BEDFORD.*

Professor Shaun Vahey. *PHOTO BY LEANNE O'ROURKES.*

Setting in the shadows

A new shadow Reserve Bank of Australia board aims to shed light on interest rate setting. By **LEANNE O'ROURKES**.

As any Australian with an overstretched home loan knows all too well, small interest rate hikes can lead to significant changes in people's lives. But when the Reserve Bank of Australia (RBA) Board meets each month, we're told what the base interest rate is and we're given very few other details. We may feel the financial hit, but not many people ask why.

That's one of the reasons why researchers at the Centre for Applied Macroeconomic Analysis in the ANU College of Business and Economics embarked on a pilot project to explore the possibilities for transparency and better communications for interest rate setting in Australia. It involved recruiting a panel of expert economists for a Shadow RBA Board.

"The plan is that we work with a group of experts who make judgements about the interest rate that the RBA should set at the next meeting," says Director of the Centre, Professor Shaun Vahey. "It's not about forecasting, it's about weighting interest rates appropriately to reflect each expert's beliefs.

"The RBA Board is drawn from the Central Bank, economists and business people, and around the world that's not typical central bank practice. We're going for a more expert-based approach and that allows us to put more info on the table than the RBA does.

"The RBA gives you a view of what the board as a whole thinks is the right interest rate but they don't admit that any other rate is feasible for the current economic climate. We're able to tell you more about the uncertainty around the interest rate decision, but also we're able to put out the views of each individual expert, whereas in the current RBA structure, that's not feasible."

Central banks around the world are broadly members of two camps. For example, in Norway people are drawn from different parts of society to represent different views like business and unions. The second kind, like the British board, is made up of experts, similar to the Shadow RBA model. But Australia's RBA model is different again.

"To my knowledge, none of the other banks solve the issue of having a single or many views the way the RBA does, which is to have a bunch of business people on the board and, most controversially, a presence from the Treasury," says Vahey.

"But we're certainly not saying that the RBA should adopt an expert-based board. Given that we want to express and experiment with ways of communicating, it's natural for us to include lots of different people with different views on the Shadow Board and that leads to the expert case.

"The main aim of the project is to study forms of communication, both for internal Central Bank use and from the Central Bank to the public. So it's about transparency and to some extent, accountability, and the Shadow Board is a tool that we're using to conduct our experiments."

As part of the pilot project, the Shadow RBA Board provides its verdict on the Thursday before the RBA Board's decision on whether to lift, drop or stabilise interest rates. Plans are underway to expand the program in early 2012.

The extra information available through the project could be just what mortgage-holders need to answer their questions. ■

Shadow Reserve Bank of Australia Board members:

Paul Bloxham
Chief Economist for HSBC in Australia and New Zealand.

Mark Crosby, Chair of Shadow Board
Associate Professor of Economics and Associate Dean (International) at Melbourne Business School.

Mardi Dungey
Professor and Chair of the School of Economics at the University of Tasmania.

Saul Eslake
Director of the Productivity Growth Program at the Grattan Institute.

Bob Gregory
Emeritus Professor at the Research School of Economics at ANU.

James Morley
Professor of Economics at the University of New South Wales.

Jeffrey Sheen
Professor and Head of the Department of Economics at Macquarie University.

Mark Thirlwell
Director of the International Economy Program at the Lowy Institute for International Policy.

Shaun Vahey
Professor at the Research School of Economics at ANU. He is Director of the Centre for Applied Macroeconomic Analysis.

War and peace and war

The dogs of war will continue to bark no matter how hard we pull the leash for peace, writes **JAMES GIGGACHER**.

The war to end all wars was one of the deadliest conflicts the world has ever seen. When the dust from howitzer blast had settled and the rattle of machine gun-fire quietened, 15 million people had died.

Despite such sacrifice, the First World War did not end wars. Instead, WWI heralded business as usual for humankind. Since those bloody times we have witnessed a second and even deadlier world war, a cold war of 50 years and two major wars of ideology in Asia. We have stormed the desert and intervened for the sake of others in Africa and the Balkans. We have even waged a war on terror. And still the body count keeps rising.

The prevalence of war is unsurprising for Dr Lacy Davey, a lecturer at the National Security College and graduate from the Department of International Relations in the ANU College of Asia and the Pacific. She says that across human history, it is peace, rather than war, which is the exception.

"We have this illusion that we're at peace when we are not fighting each other," she says. "But the reality is society is constantly preparing for war. The Cold War is a perfect example of this. We may not have had any significant 'hot wars' between the USSR and the United States, but the entire premise of society was war.

"The Cold War was an overarching and pervasive war between two nuclear-armed superpowers. It was total because the activity of war, in this case the use of nuclear weapons, had become so destructive it would guarantee the mutual annihilation of both sides.

"The all-pervasive nature of the Cold War was also seen in the threat that the use of nuclear weapons posed. The destructiveness of these weapons is so profound that during the Cold War society sought to create a way to harness their potential without actually having to use them. This is what is known in strategic studies as deterrence tactics. Essentially it established a common understanding that if you want peace, prepare for war."

According to Davey war is the blood tie that binds the world together. She says that rather than just being a force for destruction and chaos, war helps achieve a sense of order in international relations.

> "If you want peace, prepare for war."

Over time it has also become an acceptable way of conducting politics at a global level, or what she calls a social institution.

"An institution is more of an abstract concept than what we might immediately think. For most people it is an organisation; something like the United Nations or a government body," explains Davey.

"But I'd argue you can make a very strict distinction between organisations and institutions. Organisations are the mechanical bodies or the actual manifestation of an institution. In contrast, an institution is a set of habits and practices that are geared towards the common goals of international society.

"So in that respect when we think of war as an institution, we are thinking of war not as the military or the armed forces, which are part of war, but are a war organisation. Instead, the institution of war can be seen as a set of habits and practices or a set of rules, norms and values that contribute to common goals in international society, which are the right to life, truth and property.

"And this is where my argument gets a little contentious, because when we think about war we think about destruction, disorder and death. So it would seem not only illogical to argue that war helps achieve international society's common goals, but almost perverse to do so. For many people this is extremely controversial because war is the use of violence to achieve an end and for a lot of people that's just unacceptable."

People would be justified in their objections. Life, truth and property are often among the first victims of war. While Davey acknowledges that this makes the value of war as a social institution a bone of contention, she also points out that war has been used to defend these very same values. In recent times violence has been used to end violence – as in the case of humanitarian war.

"What we see in most of history is that justifications for war are grouped into three areas; identity, rights and necessity," she says. "Now when we talk about rights it's not just entitlements. There are positive and negative rights; things that I'm not allowed to do and things that I'm entitled to do. So I have responsibilities and obligations as well as entitlements. But in war it is most often those things that you are responsible for, like life, truth and property, which get violated.

"Now whether two wrongs make a right is questionable and again that's why this becomes contentious. People turn around and say 'But hang on a moment, is it morally right to sacrifice life, to destroy property and to go against your treaties with other states in order to achieve rights for those who are having their rights violated?' But at the same time there's a justificatory process, the responsibility to protect, which allows us to go to war for humanitarian purposes; to kill people in order to stop people being killed."

Not only will we continue to wage war in the name of others; we'll continue to wage war in any other name. While the doves may be circling, the hawks are definitely here to stay. Because, when push comes to shove in global politics war is not necessarily a means of last resort. Davey says that many states still see war as the most effective means of achieving their needs, particularly since the way war is now conducted reduces its inherent risk.

"Today you can be an American in the armed forces and fly an aeroplane that drops a bomb on a military target and kills a huge number of people but you do this sitting in your hometown in America. You go to work 9 to 5, you fly these little remote-control planes and then you go home to your family.

"Until we reduce that though, until we are able to step back into an environment where there is more personal risk involved in terms of actually having to fight, I don't think war is going anywhere. It's useful; you achieve purposes quickly and with relatively little personal risk. At one point down the track we might be able to get rid of it, but not right now and not in the immediate future." ■

Dr Lacy Davey. *PHOTO BY BELINDA PRATTEN.*

Grains for gains

Jill Gready's potentially world-changing plant engineering techniques could help save millions of people from starvation. By **LEANNE O'ROURKES**.

The world's population reached seven billion this year and that human explosion means mankind has some tough challenges ahead. Not the least of them is the looming food crisis, because more people means more mouths to feed.

If rich countries reduce their unscrupulous waste, we might find an answer. But solutions can also be found in science, including in higher-yielding, genetically-engineered crops. Although ethical and safety questions surround their development and use, can we afford not to invest in them? Professor Jill Gready from The John Curtin School of Medical Research says it's a matter of necessity.

"Countries with large populations, including nations like India and China, have assessed options for providing enough food in a world increasingly limited by resources such as land, water and fertiliser," she says. "And they've concluded that if the choice is between eating and starving, they'll accept genetically modified crops."

According to Gready, the serious ethical issues surrounding agriculture and technology stem from historical under-investment by public bodies in food production. Multinational agricultural biotech companies have stepped in to fill the gap, and as a result, they own and therefore control access to most of the technology.

Recently, Gready and her team of researchers have had a breakthrough in photosynthesis improvement, which involves looking at reaction pathways in the chloroplasts of plants, and it all comes down to one small, powerful enzyme – Rubisco.

"There are a number of reactions that determine the efficiency of the plant processes of photosynthesis which turn carbon dioxide, water and energy from sunlight into sugars and oxygen that give us food and life," says Gready.

However, the main efficiency block is Rubisco itself, because it operates imperfectly and at a slow pace.

"I'm a Rubisco enthusiast," says Gready. "I think it's unfair to call Rubisco slow and leaky because it's the only thing that does this so it has no competitors. If it wasn't there, we wouldn't have life. By slow and inefficient, people mean in comparison with most other enzymes in nature, but none of these has as difficult a job as Rubisco.

"The great news is that we've achieved significant results in terms of potential yield increases in our test plants.

"Improving photosynthetic efficiency has other benefits too. A better Rubisco would not only produce higher-yield crops under normal conditions, but would also increase crop resilience under drought and poor-soil conditions by making more effective use of scarce inputs of water and nitrogen.

"This better Rubisco takes free resources – sunlight and carbon dioxide – and value-adds them to produce sugars with oxygen as a bonus to give

Professor Jill Gready. *PHOTO BY BELINDA PRATTEN.*

you more bang for your buck, at the same time as reducing your inputs of water and nitrogen in fertiliser. So the technology's clearly potentially very powerful."

The crunch is that most of the people worst affected by the food crisis will not be able to afford this crop improvement technology, if developed and marketed by major corporations. But Gready's determined – not only to jump over the genetic hurdles but also to leap the humanitarian ones to deliver these improvements to subsistence farmers. ANU and Gready have recently struck an agreement with Bayer Bioscience to develop the technology. The agreement allows for royalty-free licences to international and national agricultural bodies that develop food crop varieties for subsistence farmers in developing countries. Essentially, it means that those who might well need it the most, are getting the technology free.

"The agreement term that allows the results of our collaborative research to be used for developing crops for poor farmers will not cost Bayer anything because these poor farmers are never going to be able to buy crops developed for the commercial market as they don't have the money.

> "What it means for the poor farmer, however, is to benefit from current world-best crop technology.

"What it means for the poor farmer, however, is to benefit from current, world-best crop technology. This could be the difference between a crop and no crop in some cases, but in normal circumstances would reduce the farmer's need for scarce inputs.

"At least half of the world's population are subsistence farmers, mainly clustered in particular countries in Asia and in Africa. So more than three billion people could benefit from this free technology now, and millions more, born during the population explosion, could be assisted by it in the future."

There is still some way to go to develop the technology needed to implement better Rubiscos into all major food crops. But the limiting factors here are not based in science but in funding and the will to do it. Little attention has been paid to the area in the last decade.

"Attending to the world food crisis is everyone's responsibility. It's already with us. We've seen unrest in the Middle East and food riots in many countries globally – the Philippines, Vietnam, Mexico – so it's clearly in the best interests of all of us to pursue innovative solutions." ■

Rockets and all that jazz

An ANU invention is set to give humanity a fast track to the stars, writes **JAMES GIGGACHER**.

Beyond this blue planet we call home there is a sparkling sea without end. On a clear night it flickers with the promise of a billion unknown worlds. Drawn by the pulsing lights of these countless galaxies, stars and solar systems, humanity has hurtled stellar pioneers into the celestial swirl. Telescopes, rockets, satellites and probes have beamed back images and samples of what lies 'out there', in the great beyond. We have sneaked a peek into the universe's dark heart.

Now, two ANU researchers are helping to open up the heavens and bridge the distance in our cosmos. Their revolutionary 'plasma thruster' engine has the potential to propel satellite technology and exploratory missions into the furthest reaches of deep space. Invented by Professor Christine Charles from the Plasma Research Laboratory in the ANU College of Physical and Mathematical Sciences, the Helicon Double Layer Thruster (HDLT) is the first space propulsion system of its kind in the world. It is based on technology developed by her lab partner of 24 years, Professor Rod Boswell.

The two are busily getting the engine ready for spaceflight. They've teamed-up with EADS-Astrium, the world's largest aeronautics and aerospace company, Australian company VIPAC and the Surrey Space Centre in the United Kingdom to develop and launch a prototype. If successful, the engine could be used in satellites and deep space missions as soon as 2013. Before a countdown has even begun, the engine is already attracting a lot of attention, particularly from the European Space Agency. Charles says it's because plasma engines are the future of all space exploration and satellite activities.

> "As long as you provide the power and the propellant you can go forever. With the right development this technology might get us very, very far… and hopefully back again."

"When you look at what all the world's space agencies have been saying and how they have described deep space travel or missions, pretty much all of them have said that it will happen with what is called magneto plasma thrusters."

Plasma engines offer a range of benefits not found in conventional chemical rockets currently used for space travel. They are more efficient for longer periods of time and will extend the range of human and robotic exploration of the solar system and beyond. The HDLT also promises to speed-up journeys through space, getting us to Mars in just three months – half the time it currently takes.

"The velocity of a plasma thruster increases with time and they can also get to very high velocities," explains Charles. "The HDLT is also really cheap. It can use all sorts of propellants and it doesn't use much of these. We've tested ten types of propellants and it's worked for all of them.

"The HDLT can also work with carbon dioxide. So with planets like Mars and Venus where you mostly have carbon dioxide in the atmosphere, you could refuel as you go. This is a great advantage because at the moment all missions require that you carry the propellants from Earth.

"There are also no major issues with parts or erosion. As long as you provide the power and the propellant you can go forever. So with the right development this technology might get us very, very far… and hopefully back again."

The HDLT is an incredibly simple engine. It uses plasma – gases made up of electrically charged particles – to provide a thrust. Gas is injected into a glass bottle or tube which is open at one end. It is then bombarded by radio waves through copper wire which is wrapped around the tube-like chamber. This ionises the gas to create the plasma which is accelerated when it leaves the bottle. The process is known as the 'double layer'.

"What we have found is that if you apply a magnetic field by using coils around your bottle, and if you have the right magnetic configuration, you have this phenomenon which is called the double layer," explains Charles. "This forms just at the exit of the bottle. And it's like a waterfall effect; all the ions that are created in the bottle will go through this waterfall and get accelerated before they are emitted from the bottle. So that will create a push in the opposite direction and that's how you get your thrust."

Even though Charles has always been interested in plasma, she made her breakthrough while marching to the beat of a different drum. At the time of her discovery the experimental physicist was studying jazz arrangement and composition at the ANU School of Music.

"When I came to ANU from France I was on a short-term contract," she

Professor Christine Charles. *PHOTO BY TIM WETHERELL.*

says. "But experimental physics is a really expensive business and it is quite difficult to get money for the experiments and salaries. So we ran out of money.

"The only solution was to go part-time. At the time I was taking casual music lessons and after some encouragement decided to do an undergraduate degree in music. It was a really fantastic opportunity. But, because I felt I might be losing my touch with physics, I decided to use all my free time to carry out experiments in the lab. That's when I found that I actually could create a pretty well-defined double layer thrust.

"This double layer is beautiful. It is responsible for accelerating the electrons which produce the aurora at the South and North Pole. And it possibly explains the acceleration of the solar wind when it leaves the Sun and goes out into the universe. It has also been found in neutron stars. So when I found it I was very excited. It was beautiful and I knew that I hadn't lost my touch."

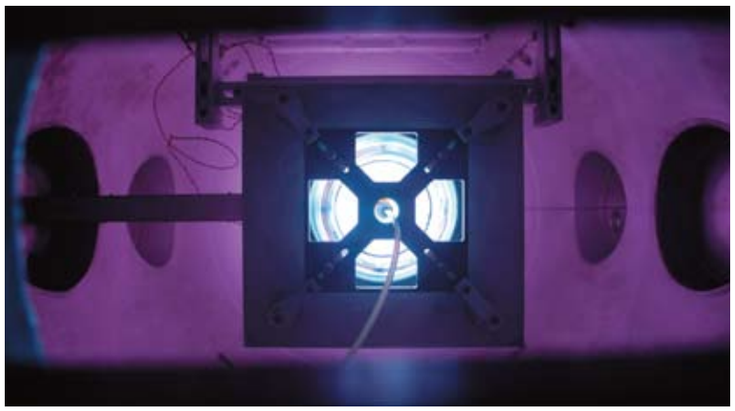
Tuning into her passion for plasma has provided more music for Charles' ears. Earlier this year, she and Boswell won a $3.1 million grant from the Australian Government to make sure their engine gets off the ground. Most of the grant money will go to building a space simulation facility at ANU which will incorporate a thermal/vacuum device to enable testing of the HDLT and other satellites in space-like conditions. The facility will also be made available to other scientists, astronomers and industry bodies seeking to develop space equipment as well as the team working on the Giant Magellan Telescope.

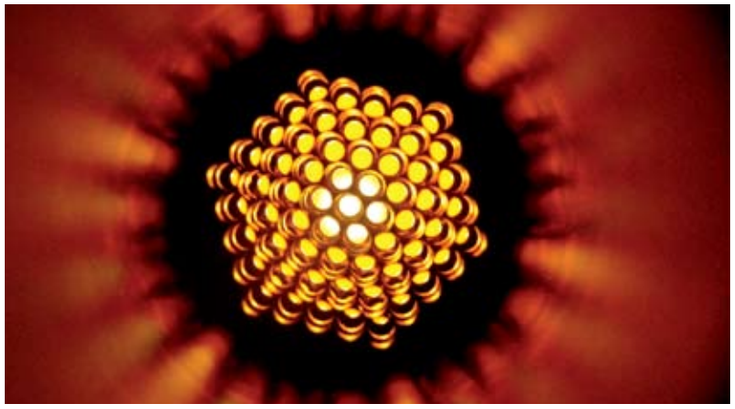
Once their prototype is launched into low-Earth orbit it will be the first time in many years that a piece of Australian hardware has been sent into space – signalling a return to the glory days of Australia's contribution to the space business.

For Charles it's something truly out of this world.

"Can you imagine it?" she asks with a smile. "I don't know for sure that it is going to happen, but after more than 20 years of hard work and research we have the chance to watch something launched which we can say is ours. I think that's quite cool."

And who knows just how far the plasma thruster will take Charles, Boswell and the rest of us. Where ever it ends up, it promises to be an exciting journey. ■





Top: The view inside the HDLT plasma thruster as seen from behind.
Bottom: Grids in the plasma thruster engine glow red and orange.
PHOTOS COURTESY OF THE ANU PLASMA RESEARCH LABORATORY.

Living with the law

Have you ever driven past a prison and wondered what it would be like if you found yourself on the other side of the wire? A group of ANU students had the opportunity to find out, writes **LUCY WEDLOCK**.

Amy Sinclair, Professor Simon Rice and John Croker. *PHOTO BY BELINDA PRATTEN.*

In any career, it's one thing to learn the theory, but until you've had the opportunity to put it into practice, you don't have a thorough understanding.

Studying a Bachelor of Law, for example, helps students understand a case and interpret an Act. But going into a prison and building a trusting relationship with the inmates puts a human face to legal theory.

Amy Sinclair is one of eight students who, over six weeks, ran a workshop for inmates of the Alexander Maconochie Centre (AMC) on the outskirts of Canberra. The workshop aimed to provide inmates with an understanding of law as it relates to their own experiences within the Centre.

"I was drawn to the program out of curiosity. Driving past the prison I often wondered what goes on behind the fences. But it's what kept me coming back that surprised me the most – the genuine connection that we made as a group with the prisoners," says Sinclair.

The workshop gave inmates at AMC the chance to voice their concerns and learn more about legal processes, but also aspects of human rights and responsibilities. Student co-ordinator John Croker has been involved since the program's inception.

"We look at the Human Rights Act and international prisoner and human rights treaties," says Croker.

"Then we drill down into how that affects the prisoners' lives and incarceration. We emphasise that with human rights you have a reciprocity which is quite important. Some people who have been in prison before might have some difficulty in recognising and respecting the rights of other people.

"Giving them this information isn't reinforcing their incarceration and helplessness; we are saying that these are the processes for change. We look at how laws are made, and then implemented, and at what point people can contribute to that formulation and ongoing change."

Director of the program Associate Professor Simon Rice says that the law doesn't just need to evolve, but also protect all members of society.

"Law has the capacity to redress social injustice in a number of ways, such as controlling behaviour, giving rights and remedies, allocating power and promoting attitudes," says Rice.

These are the messages that the students take into the Centre. But taking those first steps behind the bars can be daunting.

"I was pretty nervous the first week and I could tell that my colleagues were too," says Sinclair.

> "We're all just a few poor decisions away from their situation."

"We had been through a safety training program and had some pretty harrowing advice about physical and psychological violence within the prison. The only image I had in my head of prisoners were from TV dramas, so I expected to greet a room full of enormous guys in orange jumpsuits with tattooed eyeballs and bad attitudes.

"I was blown away to instead meet a group of ordinary guys who I wouldn't think twice about sitting next to on the bus. The degree of intellectual engagement they brought to each discussion, and the extent to which they were willing to share their personal experiences of the court process and life within prison was enlightening.

"The big lesson for us was that fundamentally we're all just a few poor decisions away from their situation and it helps to remember that just because a person has been convicted of a crime, it doesn't change the fact that they are still ordinary people with mortgages, families, ambitions and personal philosophies," says Sinclair.

Rice says: "For students, the project gives their classroom studies context and depth and a chance to reflect on lawyers' moral and ethical responsibilities.

"For the prisoners, the project gives them an understanding of law – the opportunities it offers and the demands it makes – enabling them to participate more effectively in society." ■

Skin deep

Dr Deborah Hill tells **KATHARINE PIERCE** how a vest picked up in a Thai junk shop inspired her to research more about traditional Thai tattooing.

The little things in life, we're told, are not worth worrying about. Instead, it's the big picture that we need to look at and focus on. But in the world of traditional Thai tattooing, the big picture is just a small part of the overall story. For the tattoo artists who decorate their canvases of flesh with intricate patterns, lines and designs, the finest details in their work can have enormous meaning.

"Sometimes even the tiniest design can have an absolute plethora of spiritual meaning for someone," says art historian and recent ANU graduate Dr Deborah Hill.

"For example, in some cultures when artists give people tattoos of animals, they'll put the eye in last as that finishes the image and brings it to life. It's not until that end point where a tattooist sparks the artwork into life. Until that final point, it's just an image."

Hill was inspired to find out more about the ancient and mysterious practice of tattooing in Thailand after her supervisor showed her a talismanic vest.

"She had picked up this vest in a junk shop in Chang Mai and said 'Wow that would make an interesting thesis'," says Hill.

"When I looked into it what I found was there was a lot of popular material and a few historical examples of tattooing, but it all looked kind of confusing and mixed up. So I was keen to sort it out."

When her research was complete, the picture that was painted was a kaleidoscope. Hill learnt that Thai tattoos, much like the country's dialect, differ from region to region. It was through her experience as an art historian that she figured out a way to identify where tattoos came from and what they were based on.

"What I came to realise was that the tattoos had both a geographical element and a religious element," says Hill.

"In northern Thailand, particularly in the region of Chang Mai where there are a lot of tribal people, tattoos have a very specific look. Whereas in Bangkok, [the monks] will tattoo images of the Buddha. Also, the text tattoos will be Buddhist chants or mantras rather than incantations or spells, which is what you'll see up in the north."

It's not just locals who are drawn into the world of traditional Thai tattoos. From the lowly tourist to the rich and famous, people from all over the globe flock to the Southeast Asian nation to get their ink on. One famous example of Thai tattooing can be found on the arm of actress Angelina Jolie.

The issue provokes strong feelings in Thailand. There have even been calls from within the Thai government to bar tourists from getting these highly ritualised and spiritual tattoos.

"Some people really do crave that authentic tattoo experience, and to get a monk to do their tattoo would appeal to some. But the tattoos are sacred things," says Hill.

"Having a Thai tattoo also comes with great responsibility. There's a belief that when certain deities are tattooed onto the body, part of that deity will occupy you. So there are many taboos you need to honour in order to keep the deity acting beneficially for you."

Hill explains that according to belief, if you break these taboos, you might find yourself in a position where you become possessed by the spirit of your tattoo. But before you start worrying about your own body art, you may be disappointed to learn that your decorative tattoo possesses no power to protect or bless you. Traditional Thai tattooists believe that tattoos done by electric machines, and not traditional implements, hold no spiritual or authoritative powers.

Even so, just as traditional Thai tattoos hold great importance to their bearers, the same can be said about our own tattoos.

"A tattoo is a representation of your life at a certain point, and regardless of how it ages or deteriorates it's a visual memory and a marker of our experience in a particular time and space," says Hill. ■

Dr Deborah Hill. *PHOTO BY JAMES GIGGACHER.*

catch up

Been a while since you visited the ANU campus? That doesn't mean you should miss out on the many events taking place at the University.

Check out the latest podcasts at: anu.edu.au/podcasts
Watch the latest videos at: youtube.com/ANUchannel

Tales of stars and stellar systems

Dr Helmut Jerjen
Research School of Astronomy and Astrophysics, ANU

Watch: bit.ly/rep_jerjen

In the first of this two-part video, Dr Jerjen tells the stories written in the night sky. On a journey through space and time, he explores the glorious life of our sun, discusses how astrophysical knowledge acquired 100 years ago can help to solve the energy crisis on Earth today and explains why we should rightfully call ourselves the children of the stars.

Dr Jerjen also explains how astronomers measure the faint signals from distant worlds, shows us where our place in the Milky Way is and reveals how the universe grew a million times bigger on the night of 6 October, 1923.

Nation, Religion, King

Presented by Dr Nicholas Farrelly
ANU College of Asia and the Pacific

Watch: bit.ly/rep_NRK

This three part series brings together some of the world's leading experts on Thailand. The series is presented by ANU Southeast Asia specialist Dr Nicholas Farrelly from the College of Asia and the Pacific, and is produced in cooperation with the annual Thailand Update and the National Thai Studies Centre.

The second episode – *Sasana: Religion* – features Dr Anders Engvall, Daungyewa Utarasint, Saran Santisart and Professor Des Ball analysing the political and social conflicts in southern Thailand, and discussing whether the new government has any chance of resolving that region's ongoing problems

Vienna in Canberra: concert and book-reading

Shmuel Barzilai and Professor Tim Bonyhady

Watch: bit.ly/rep_vienna

In this video, international tenor and chief cantor of the Vienna Jewish community Shmuel Barzilai performs traditional Yiddish songs, connecting listeners with the rich cultural and musical tradition of the Jews of Eastern Europe.

Art historian and environmental lawyer Professor Tim Bonyhady also reads extracts from his latest book *Good Living Street*, which details the lives of three generations of women in his Jewish family and their eventual escape from Nazi-occupied Austria.

bookshelf

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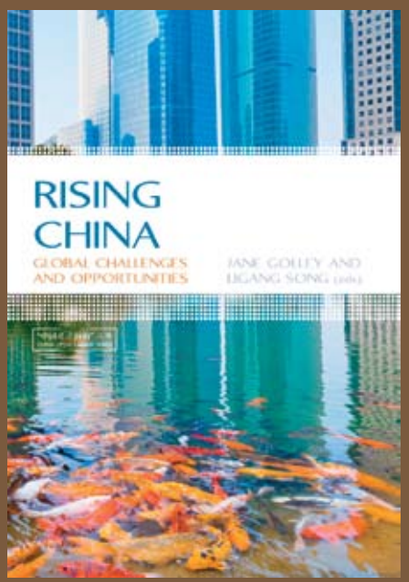

Rising China

Global challenges and opportunities
Edited by Jane Golley and Ligang Song

The last three decades of the 20th century saw China take to the global economic stage. The first three decades of the 21st century are almost certain to bring with them the completion of that rise, not only in economic terms but also in global politics and international affairs.

Accommodating China's rise in a way that ensures the future stability and prosperity of the world economy and international society is one of the most important tasks facing the world community in the first half of this century. This book delves into these issues and reflects upon the wide range of opportunities and challenges that a rising China presents.

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Image (detail) Lorna Fencer Napurrurla, *Water Dreaming*, 1999, synthetic polymer paint on canvas, 120 x 120 cm, Courtesy of Markus Spazzapan and Suzan Cox, Darwin.
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