

SYDNEY ALUMNI MAGAZINE

ISSUE 11 — SEMESTER ONE 2020



THE UNIVERSITY OF  
SYDNEY

# SAM

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Ancient Egypt,  
new insights

TECHNOLOGY

The solace  
of quantum

HEALTH

Alcohol and babies  
don't mix







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# A COMMUNITY DEDICATED TO FINDING SOLUTIONS.

It has been a challenging start to 2020. The devastating bushfires and the coronavirus outbreak have impacted so many of our students, staff and alumni. It has been heartening, however, to see how we come together as a community in times of great uncertainty.

During these crises, universities have the technical expertise, infrastructure and resources to contribute to social outreach – immediately and in the longer term. This role is a responsibility to the communities we serve and embedded in our 170-year history.

In the aftermath of the bushfires, Sydney mobilised 500 researchers across more than 60 fields, including medicine and health, engineering, ecology, sustainability, environmental and climate sciences, to lend their expertise over the short, medium and long term.

Our world-renowned researchers enhanced understanding of the bushfires and the staggering toll they took on human life and our precious ecosystems. Professor Chris Dickman made global headlines with his estimation that one billion animals had perished.

The dedication of staff working with other researchers and community partners has been inspirational, making a measurable difference to communities and our environment, as we adapt to climate change.

But the University cannot achieve

these outcomes alone. Engagement with our donors and partners across industry, media, government and civil society underpins our ability to find innovative solutions to pressing challenges.

Universities can leverage their substantial teaching and research expertise to contribute to global priorities such as climate change mitigation and adaption, food security and health emergencies. During the COVID-19 outbreak, a team at the University and NSW Health grew the live virus to help diagnose and contain its spread. Meanwhile, we are partnering with Qantas to reduce its annual CO<sub>2</sub> emissions by 50 million kg and with the City of Sydney council on increasing access to healthy and affordable food.

Communicating the relevance of our teaching and research ensures the University remains globally relevant and stays true to our fundamental mission: to create opportunities for our staff and students to excel, whatever their background. Those opportunities translate into life-changing benefits for the communities we serve, through collaboration and commercialisation.

The end game is that universities have a profound influence on policy, practice and future prosperity. Our culture of excellence reinforces our commitment to proactive leadership for the greater good.



Belinda Hutchinson AM  
(BSc '76), Chancellor



Dr Michael Spence AC  
(BA '85 LLB '87),  
Vice-Chancellor and Principal

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to enable scientists to work  
with materials at the nanoscale.  
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## COMMUNITY

## The Vice-Chancellor announces his departure

Later this year, the University will farewell its Vice-Chancellor of 12 years, Dr Michael Spence AC.

Dr Spence will leave in December, to become President and Provost of University College London.

“This decision is not one I have taken lightly,” said Dr Spence. “I am sad to be leaving an institution that has been so formative for me and to which I have such deep loyalty, having been either a student or a member of staff at the University for more than a third of my life.”

The Chancellor, Belinda Hutchinson, expressed the gratitude and good wishes of the whole University community. “Under Dr Spence’s leadership, the University of Sydney has grown in size and stature,” she said. “We are tremendously grateful for his efforts and have no doubt that he and his wonderful family will continue to thrive in London.”

The Chancellor confirmed that a national and international search for a new Vice-Chancellor and Principal had begun.



After 12 years modernising and expanding the University, Vice-Chancellor Michael Spence has announced his departure.

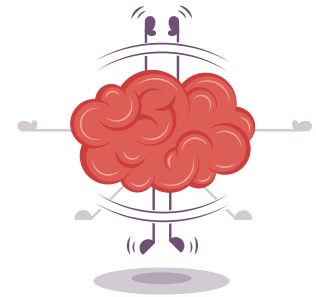


Opioids have been extracted from plants, but a painkiller of the future may come from a fungus.

## MEDICINE

## Pain relief without the downside

A previously unknown fungus, *Penicillium* sp., may solve the biggest problem with prescription opioid painkillers: the possibility of addiction. Found in a Tasmanian river estuary by an international team led by the University, a microscopic examination of the fungus revealed structures that mimic endomorphins, the natural opioid neurotransmitters central to pain relief. In the laboratory, *Penicillium* sp. has already been turned into a new kind of opioid with fewer side effects, and a patent application has been filed. Now underway is the long and painful process of making sure it is indeed a safe and workable medication.



## EDUCATION

## An exercise in learning

Is there anything exercise isn’t good for? According to a recent University of Sydney study conducted with University College London, exercise even benefits classroom learning. An assessment of 42 international studies found that students who do activities like star jumps or running on the spot during school lessons do better in tests than those who just sit at their desks. Senior author Professor Emmanuel Stamatakis from the Charles Perkins Centre says that simple activities can make a big difference. “Standing up to answer a question or running up to the board to write down an answer, adds to schooltime activity and could lead to improved academic performance.”





ECOLOGY

**They were guerrilla fighters in a lengthy civil war. Now they're protecting Colombia's pristine, richly biodiverse jungles. Jaime Gongora is helping them win the battle and build themselves new lives.**

# It's a jungle out there

Written by  
Eleanor Whitworth

Illustration by  
Guy Shield









🔥 Growing up in a war-torn country changes you. For Associate Professor, Jaime Gongora, born and raised in South America's troubled Colombia, it ignited a passion for building social cohesion and giving back to community. "A scientist must have a commitment to society to ask more than just the scientific questions," he says, in his office at the University of Sydney, spreading his arms almost as wide as the couch he's sitting on.

Seeking a life with greater safety and certainty, Gongora emigrated to Australia in 1999 to pursue a career as a wildlife genetics specialist. But when an opportunity arose to contribute to the healing of his home country, and to simultaneously preserve its natural habitats, he jumped at the chance.

After 52 years of ruthless civil war sparked by inequalities in land ownership, the Revolutionary Armed Forces of Colombia (FARC) and the Colombian government ceased hostilities. FARC was founded in 1964 by farmers and land workers who spent the war years, and often the majority of their lives, fighting from bases in the remote, mountainous jungles of the country. With the conflict over, there was the problem that all conflicts produce: how to reincorporate ex-combatants into civilian life.

Gongora, with some sadness in his voice, explains, "In Colombia, many people have been subject to violence, directly and indirectly. It has been a very stressful environment. But we have always been optimistic that one day this will change."

One opportunity that has emerged is an unexpected benefit of the war itself. Despite terrible damage and loss of life, the war kept development out of the jungles, leaving Colombia's unique ecosystems in relative peace.

It's hard to envision the complexity and beauty of these ecosystems which might contain rare mammals like the giant otter and brown spider monkey, and flora like the dramatic Dracula orchid and the endangered national flower, the Flor de Mayo. "Even with your eyes closed, you can feel the intensity of the colour green!" says Gongora. Colombia's habitats, from coast to mountains



## Jaime Gongora

### DEGREE

PhD (Vet Science) '04

### THE THING YOU NEVER WANT TO DO AGAIN

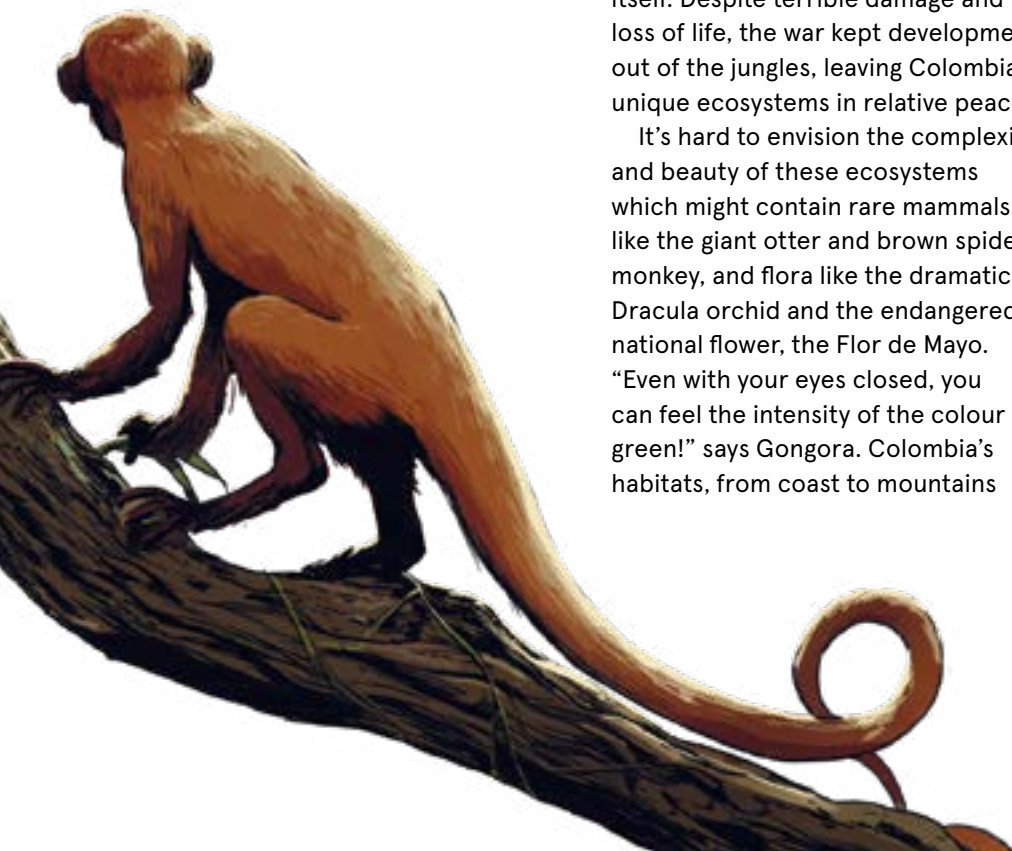
Hold a juvenile crocodile in my hands without securing its mouth first.

### EARLIEST MEMORY

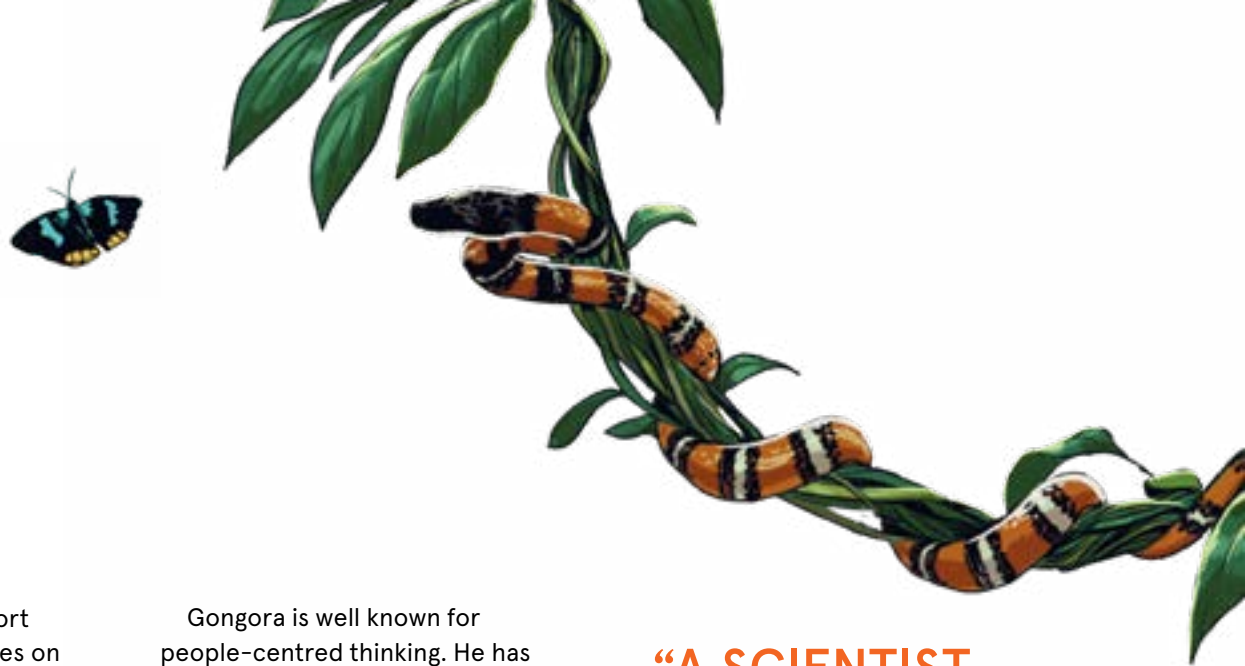
Being four or five in a big green chair and pretending I could read this big newspaper. Then someone turned it the right way up for me!

### WHAT ELSE YOU MIGHT HAVE BEEN

A lawyer to defend people's rights or a farmer in sustainable agriculture and animal production.







to savanna to rainforest, support 10 percent of the known species on earth, including 18 percent of all bird species – the most of any country.

Biodiversity and natural environments like these underpin human fundamentals. They support clean water and air, food security, and even provide resources for medical research. In a warming world, there are few things more important than protecting these vulnerable places and the creatures that exist in them.

Colombia's fledgling peace and stability exposes these ecosystems and the resources they contain to exploitation. This vulnerability was recognised early by the UK's Earlham Institute which supports research into living systems. The institute started a project to focus on Colombia's genetics and biodiversity. A one-time PhD student of Gongora's, Amanda Chong, was working there and suggested he get involved. Gongora agreed but contributed some ideas. "The project was missing something," he says. "In a post-conflict situation, it's very important to consider the social aspect of reincorporation of ex-combatants."

One idea was simple but powerful. Gongora suggested retraining the ex-guerrilla fighters of FARC, who'd spent so many years hidden in the most remote parts of the jungle, to become protectors of the jungles and come up with environment-based business ideas.

Gongora is well known for people-centred thinking. He has received multiple international awards for his achievements in education and promoting diversity. At the University he is recognised for embedding cultural competence into the University's veterinary curriculum and celebrating Aboriginal and Torres Strait Islander cultures.

His ability to integrate ideas and bring people together also proved invaluable in preparing for the training project through three years of careful consultation with ex-combatants, police, paramilitary and government.

**“A SCIENTIST  
MUST HAVE A  
COMMITMENT  
TO SOCIETY  
TO ASK MORE  
THAN JUST  
THE SCIENTIFIC  
QUESTIONS.”**

— Jaime Gongora



It took three years for Jaime Gongora (right) and a team of scientists, ex-combatants and others, to put the eco-tourism workshop together.



The process, led by the Earlham Institute in partnership with the University of Sydney and supported by the UK's Global Challenges Research Fund (GCRF), resulted in the development of a practical workshop program for ex-FARC members. "We wanted to equip ex-combatants with something positive they can take into the future," says Gongora.

Gongora was involved as a teacher and workshop leader at the first workshop in Bogota in July 2019 and at others located across the country – picture long car trips on bumpy roads to remote areas. By generating business opportunities based on eco-friendly approaches, the project aims to help safeguard against overdevelopment. "The main risk facing Colombia's natural environment is deforestation driven by overexpansion of the cattle industry, illegal mining, illicit crops, the expansion of the agricultural frontier and illegal timber extraction," Gongora notes.

The former guerrillas sign up for the workshops where a multidisciplinary team of teachers guides them as they brainstorm ideas that combine their lived knowledge of the jungles with scientific method.

The syllabus spans topics from taking plant samples, to handling binoculars, and forecasting how much birdwatchers would pay to sight a particular bird. After the workshops, participants can share their knowledge and plan new business ideas, such as creating nature trails where the former guerrillas can work as specialised guides, or use their learning as a foundation to pursue further educational opportunities.

The workshops have also generated local biodiversity inventories which are now resources that can be used by the ex-combatants and feed back into global scientific communities

through online repositories, contributing to a greater understanding of Colombia's natural habitats.

The extensive consultation process has been successful in other ways, "I had tears of happiness watching ex-combatants explain their plans with police and the local army chiefs. These were people who, only a few years earlier, were killing each other," Gongora says. And he remains positive despite recent news of general social unrest in Colombia and new tensions between FARC and the government.

He sees so much promise in an approach that helps to heal human society and protect the other creatures of the Earth. "To hear a puff of water vapour and to look over and see a family of dolphins visiting a temporal lake; it's extremely moving," he says. "When I talk about Colombia, I get very passionate!" he adds with a huge smile. ●

**"I HAD TEARS OF HAPPINESS WATCHING EX-COMBATANTS EXPLAIN THEIR PLANS WITH POLICE AND THE LOCAL ARMY CHIEFS."**

— Jaime Gongora

Eco-tourism offers ex-guerrilla fighters a future, with bird watchers willing to pay generously to be guided to the right bird.





# We're unlearning air travel to reduce its impact

By partnering with Qantas, our researchers are improving passenger wellbeing on long-haul flights and are optimising flight paths to reduce fuel emissions.

Find out how we're unlearning the world's greatest challenges.  
[sydney.edu.au/our-research](https://sydney.edu.au/our-research)



THE UNIVERSITY OF  
**SYDNEY**

Leadership for good starts here







**As Australia grapples with issues around freedom of the press, Malaysia has made real progress. It is now rated as the most journalistically free nation in the Southeast Asian region. Premesh Chandran helped power that liberation and is using it as a tool for change.**

# Truth be told

Written by  
Andrew Stafford

Collage by  
Fábio Dias

🔥 It was 2017, and the offices of Malaysia's most popular news website, *Malaysiakini*, were under siege. Outside, a crowd of up to 1000 people was angry – very, very angry – about a video on the site's TV channel critical of the government's Attorney-General, Mohamed Apandi Ali.

Ali was bringing charges against *Malaysiakini* under the Communications and Multimedia Act for refusing to withdraw the video. The crowd of government loyalists was intent on taking matters into its own hands. "They were

banging at our gates and threatening to invade the compound," remembers CEO Premesh Chandran (MIntS '96).

Police eventually dispersed the crowd and the courts cleared *Malaysiakini*. For Chandran and the site's co-founder and editor, Steven Gan, it was just another day in the life of a news website that has, for the past 20 years, pushed the boundaries of press freedom in what was, until very recently, a virtual one-party state.

That changed in 2018 with the election of the Pakatan Harapan (Alliance of Hope) coalition, which defeated the

Barisan Nasional (National Front) that had ruled Malaysia since 1957, originally under the name: the Alliance Party.

The old Barisan Nasional government was reviled for its self-serving use of racial and religious division, and massive corruption, including the disappearance of \$4.5 billion dollars of public money. Crucially, *Malaysiakini*'s reporting – which survived a number of cyberattacks before the election – showed the public what was going on, and how the state media had been downplaying the significant opposition to the government's behaviour.



Weeks before the vote, *Malaysiakini* took down its paywall so that information on the candidates, their policies and the election process was freely available. Then on election night, its first-time live coverage showed the results come in, helping prevent later manipulation of the outcome.

In a supreme irony, the newly elected Pakatan Harapan was led by an alliance of two former bitter adversaries, Anwar Ibrahim and the now 94-year-old Dr Mahathir Mohamad – who was once again the prime minister (until he resigned in February this year, creating a new phase of instability).

Towards the end of his earlier 22-year prime ministership, ending in 2003, Dr Mahathir had been both friend and foe to *Malaysiakini*, which began publishing in 1999. The news site was partly motivated by a promise made by Mahathir. As a way of hopefully attracting international investment to Malaysia, he said the then-emerging internet would not be censored.

It's a promise Chandran says Mahathir has largely abided by. "In principle, the current government is behind a much more independent media. We ask tough questions, and we get tough answers, and I think that's fine."

The road hasn't been easy. "I think there was never a situation where we were not under threat," Chandran says. "It was just, are we going to get arrested tomorrow, or are we going to get arrested in six months? We were sued by the ruling party UMNO [United Malays National Organisation]; we were sued by [former prime minister] Najib Razak."

Chandran's family migrated to Australia in 1988. His parents made their home here, with his mother, Bharati Jayachandran, being a valued staff member of the University's Faculty of Health Sciences for some 20 years.



**"I think there was never a situation where we were not under threat. It was just, are we going to get arrested tomorrow, or are we going to get arrested in six months?"**

— Premesh Chandran





Chandran himself felt he had work to do in Malaysia. After completing an undergraduate degree in physics at the University of New South Wales between 1989 and 1992, he returned to Malaysia. He came back in 1995 to pursue a Master of International Studies at the University of Sydney.

It was this degree, combined with Chandran's own student activism, that prompted a move towards pursuing journalism back home. "I did work on human rights and political economy, and [the degree] gave me a more in-depth understanding of the global economy and international relations."

Starting the *Malaysiakini* website with Steven Gan was bold to say the least – they had previously been refused a newspaper license. "I do think it was a big risk. From a political point of view, whether or not the government would allow us to publish, whether we would get arrested, whether there would be political prosecutions."

This was in the early days of the internet. Since then, *Malaysiakini*'s ups and downs have mirrored, and often foreshadowed, the problems faced by international news publications in the online age. In 2002, under heavy pressure from the government, advertisers stayed away, and the portal was forced to introduce a paywall. Only 1000 subscribers joined in the first year.

"We had to write all the software for subscription. We had to come up with our own payment methods, because not many people used credit cards online. And there was no such thing as Wi-Fi, so we were using the old dial-up modems, and computers were expensive."

The following year, police raided their offices, seizing 19 computers after the publication was accused of publishing a seditious letter. This may have actually helped *Malaysiakini*'s cause:

readers rallied in support, and Mahathir reaffirmed his promise not to censor the internet, before his temporary retirement.

Now, *Malaysiakini* employs a staff of 120 people, reaching more than eight million English, Malay, Chinese and Tamil readers per month – 750,000 daily. Initially, the lack of independent media meant the publication filled a void. Since then, Chandran says, it's both surfed and led the country's transition to a more robust and open democracy.

The broad readership of *Malaysiakini* is a reflection of the multicultural, multi-religious nature of Malaysia itself. Chandran says a democratic Malaysia can form a bridge to the western, Islamic, Hindu and Chinese worlds. "We have a lot of the ingredients from Asia, but we also have a very strong western community because we are a former British colony."

Chandran says last year's election marked an important step in the country's democratic evolution. Since independence and the first general elections in 1959, Malaysia has been led for 60 years by UMNO and Barisan Nasional. "The first political change is the toughest, and to do it peacefully through the ballot box, that's not an easy process." ●



# WHAT'S IN A NAME?

It seems that Australia is now, slowly, confronting some of the brutal truths of its history. As more information is uncovered and indeed, acknowledged, it's worth noting that not all of it has been buried in libraries and museums. Some reminders of past injustices and worse, have been hidden in plain sight.

**Written by Dr Jared Field**

Dr Jared Field (BSc (AdvMaths) '13 BSc (Hons) '15) is a member of the Gomeroi clan of the Kamilaroi Nation. He was a 2015 Charlie Perkins Scholar while completing a DPhil in Mathematical Biology at Balliol College, Oxford. He is now a McKenzie Fellow at the University of Melbourne.

**Artwork by Selma Coulthard**

with thanks to the Ngurratjuta Many Hands Art Centre, Alice Springs

👉 I currently do not own a table, so all of my research occurs on the floor. By research, of course, I mean all of the formalised curiosity that I don't get paid for. That is, the answering of the vast majority of questions that niggle at my mind.

One such question, which haunts me daily, is this: who or what are the places I live among named after?

Often the answer is delightful. One example is the suburb of Prahran in Narm (or the city of Melbourne, depending on the circles in which you're trapped). I'm told that in the language of the Boon Warrung, Prahran means 'the sound of water'.

Other times, I'm somewhat ambivalent about the answer: after four years in England, I find transplanted British place names – rather like an old kidney – extraordinarily uninspiring.

It is the streets that are named after people that catch my attention. Here, however, we as a nation are greeted with a great many ugly truths.





As a case in point, consider Barkly Square in Narrm. I found myself there recently for the same reason I do not have a table – to frame an artwork (by the incredible Selma Coulthard Nunay) that any reasonable person, in my position, would say they cannot afford.

But you can get much more than picture frames at Barkly Square: clothes, food, wine and aspirin to round out the weekend. It is, otherwise put, a mundane shopping centre that dominates so much of collective life precisely because it is mundane.

Now Barkly Square, as a bit of post-framing floor research reveals, is named after one Henry Barkly. The same Henry Barkly that, according to the Legacies of British Slave-ownership database, owned or benefitted through inheritance from some 4400 slaves.

Let me repeat that: the same Henry Barkly that owned or benefitted from some 4400 slaves.

Let me correct that: the same Henry Barkly that *owned or benefitted* from some 4400 *people*.

The same Henry Barkly that, once slavery was made illegal by the Imperial Court, was indirectly compensated some £130,000 for his and his father's losses; an astronomical amount in the 1830s.

The same Henry Barkly that, once slavery was ended in the Caribbean, helped import and introduce indentured labourers (it appears for the period of about six years) from Kolkata to keep plantations afloat.

Sir Barkly is not alone in the streets of Australia but walks with familiar company. It is, unfortunately, very easy to find similar horrors in most neighbourhoods; corners and cul-de-sacs named after aristocracy that have very little to do with any Australian.

Thus, another question niggles: what are we to do with these truths?

On the one hand, removing the names seems a disservice to those that were wronged. To my mind, it allows the likes of Barkly to get off scot-free; to hide in the pages of history. On the other, to leave them as is seems perhaps worse. It would be (and indeed is) tantamount

to honouring Barkly while further subjugating the subjugated.

Perhaps then the solution is to leave the names but provide further contextualisation. Which is to say, to be nothing short of honest. Perhaps more importantly still, this route safeguards against institutional amnesia. It is all too easy to dust our hands and call a job done when really the work is only beginning.

This is just a suggestion. Of what to do practically, I am entirely unsure. What is certain, however, is this: we must examine ourselves. We need, at the very least, to learn, discuss and debate.

While, in the rest of the world, our counterparts have begun to grapple with these uncomfortable questions, it seems that we are lagging behind. In this way, our community is presented with a challenge to prove true the motto of our alma mater: *Sidere mens eadem mutato* – the same learning under new stars. ●

The views expressed in On My Mind are not necessarily those of the University of Sydney.



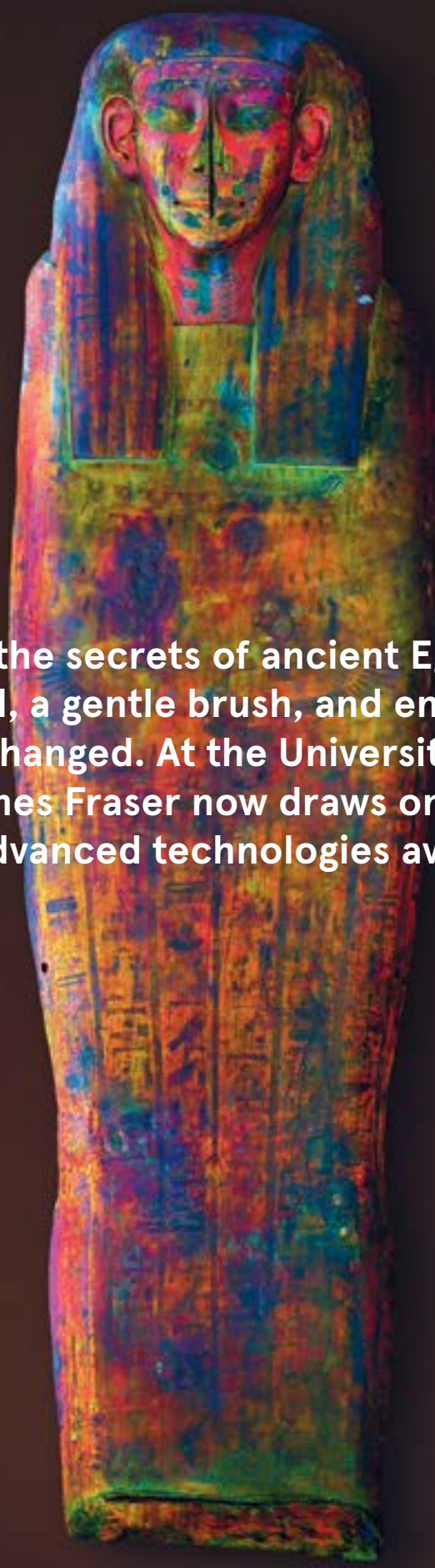




# Yummy mummies



The coffin lid of Mer-Neith-it-es, as viewed through the DStretch (decorrelation stretching) process, which exaggerates colour differences. The colours aren't true, but they highlight what is imperceptible. Image by B Drabsch & A Howells, University of Newcastle.



**Uncovering the secrets of ancient Egypt used to involve a shovel, a gentle brush, and endless patience. Things have changed. At the University's Nicholson Museum, James Fraser now draws on some of the most advanced technologies available.**

Written by

George Dodd



Senior Curator of the Nicholson  
Collection, James Fraser, with some  
tools of his archaeological trade.  
Photographer: Stefanie Zingsheim





🔥 It's beautiful and mysterious, but it lacks the lavish colours you'd expect of a mummy's coffin. The plainness makes you think it might have been for a commoner rather than a member of Egyptian nobility.

"Actually, no," says Dr James Fraser, Senior Curator at the Nicholson Museum that has the coffin in its collection. "Coffins that retain their colour are probably coated in plaster because they were made of the cheaper local woods of Egypt, like sycamore or acacia. And plaster preserves paint better than wood."

Wealthier Egyptians were placed in these wooden, human-shaped coffins, which were then placed inside a larger wooden box or stone coffin called a sarcophagus, which would also be elaborately decorated. In this case, the coffin was made 2500 years ago for a woman called Mer-Neith-it-es.

"The coffins of the wealthy were often made of imported Lebanese cedar," continues Fraser, a genial and playful academic with a gift for making you hang off his every word. "Artists were able to paint straight onto it, but over the centuries, the colours on wood fade. The lack of colour suggests it's a top-of-the-line model."

With the colours now effectively lost, the plain wood has the archaeologist in Fraser asking what the colours were. What the paints were made of. What hieroglyphs might have been present. Not so long ago, the answers would have come from educated guesswork. And Fraser's guesswork is very educated.

His first museum job after university was as an artefact registrar at the National Museum of Afghanistan, with field work in archaeological hotspots including Jordan, Iraq, Syria, Uzbekistan, Kashmir, Cambodia, and the Solomon Islands, all leading to his immediate previous

position at the British Museum. He sees archaeology as a source of lost truth.

"History is always written by the winners, the wealthy and men," he says. "Archaeology gives you a whole new perspective because it's harder to misrepresent the incidentals that fall into the archaeological layers of history."

As Fraser contemplates the coffin of Mer-Neith-it-es, his toolkit now includes technologies that are revolutionising what can be uncovered in both newly discovered objects and objects that have already been investigated but have more secrets to offer.

For some artefacts, Fraser might find himself in the University's Hybrid Theatre. Like a super-futuristic movie set, this is where robotics and advanced X-ray imaging technologies give unprecedented insights. Features locked inside objects too precious to risk damaging, are now visible and explorable in the finest detail. And of course, mummies have become an open book.

In terms of the faded mummy's coffin, the colours that could only be guessed at are now identified using a technology called vibrational spectroscopy which uses light to identify substances.

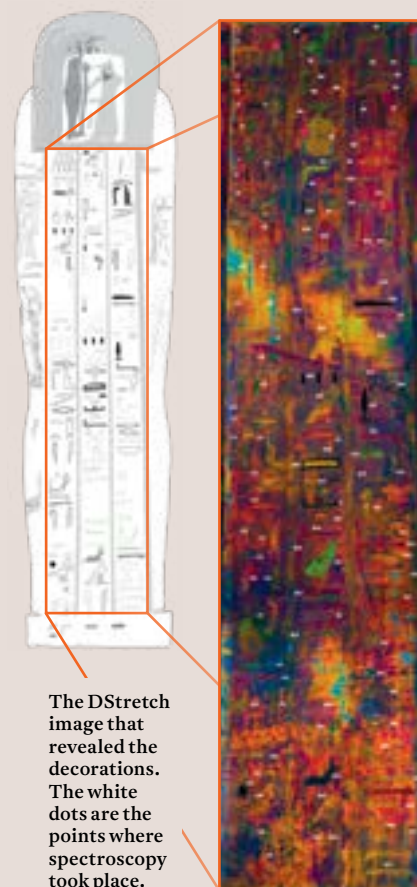
The University has the biggest concentration of spectroscopy equipment in Australia, held at the Sydney Analytical Vibrational Spectroscopy facility run by Dr Elizabeth Carter. "This has been a passion of mine since I did my postdoc in the United Kingdom," she says. "I have been working with museums since 2005 to make scientific analysis of cultural heritage an integral part of these investigations."

The story of spectroscopy goes back to ancient Rome when it was first realised that a glass prism could generate a rainbow. But the most significant

**"History is always written by the winners, the wealthy and men. Archaeology gives you a whole new perspective."**

— James Fraser

The drawing details are the now mostly invisible decorations on the coffin of Mer-Neith-it-es.





“To the naked eye,  
red is red is red.  
But chemistry shows  
that red pigments  
are very different  
from each other.”

— Elizabeth Carter



**James Fraser**

**DEGREE**

BA(Hons) '04 PhD '16

**OCCUPATIONAL  
HAZARD**

Breathing mummy dust.

**MOST PRECIOUS  
POSSESSION**

A coat I picked up in Kabul. It's part White Russian General, part Japanese schoolboy.

**HIDDEN TALENT**

Chicken whispering.

leap came in 1815 when Joseph von Fraunhofer, a physicist and optical lens manufacturer, bypassed prisms and invented a device that generated a rainbow of light so clear that it could be closely examined.

This device made it possible to examine the strange, black lines that had been noticed by previous scientists but never explained. It turned out that these lines represented wavelengths of light that had been absorbed by impurities in the glass. Later scientists found that every atom or molecule interacts with light in a way unique to that substance, like a fingerprint.

That line of thinking evolved into vibrational spectroscopy, where infrared or laser light is directed at substances and the light that passes through the substance or what is reflected back, is measured and interpreted. It's an enormously useful technology that can be miniaturised and sent to Mars for planetary surveys or used to reveal the invisible traces of paint colours on the face of a faded Egyptian coffin.

“To the naked eye, red is red is red,” says Carter, who last year won the Vice-Chancellor's Award for Outstanding Contribution to Research Excellence. “But chemistry shows that red pigments are very different from each other. It could be mercury sulphide which is vermilion, or red from lead oxide. They give very distinctive spectra.”

A key benefit of vibrational spectroscopy is that it is usually non-destructive of the original sample and can be done to a functional extent in situ (making it handy at crime scenes and for testing the ripeness of fruit in orchards).

In the laboratory, where Carter works, not all the equipment is mobile. There are systems that incorporate multiple

light sources, mirrors and microscopes, making for remarkable sensitivity.

Recent projects have included identifying the source of microplastics in Sydney Harbour and aiding in the development of pharmaceuticals.

Despite the high tech hunt for coffin colours, there is no plan to repaint the faded coffin of Mer-Neith-it-es.

In the past, precious places and objects have been restored in well-meaning ways that new information shows to be completely wrong. So, the two scientific illustrators working on the coffin, Dr Bernadette Drabsch and Andrew Howells, from the University of Newcastle, will instead produce a 3D digital recreation of how the coffin would have looked when it was first placed within its tomb.

The process started with a high-resolution 3D laser scan of the coffin, allowing elements of the coffin to be hugely magnified so the smallest details can be seen. By using digital brushes, textures and lighting effects, the recreation will mimic as closely as possible the wood grain and handmade marks on the original timber.

In a world-first idea unique to the University of Sydney, that recreation will live with the coffin itself, in the Egyptian room of the University's new Chau Chak Wing Museum, due to open August 2020. Enhancing the Nicholson's Egyptian collection with new technologies will create the most comprehensive and immersive display of Egyptian artefacts in the Southern Hemisphere.

“Something like this is extraordinary because it brings the field into the museum,” says Fraser, who has just returned from directing an archaeological excavation in Jordan. “And I love doing field work.” ●



A computer tomography (CT) scan of the contents of the coffin of Mer-Neith-it-es, giving cross-sectional pictures. Created by Macquarie Medical Imaging.

# AN



# OPEN



# QUESTION

**The modest Egyptian coffin sat quietly in the Nicholson Museum for decades with no-one guessing its mystery. When the mummy within was finally discovered, it offered an opportunity to gain new insights into the glories of that ancient civilisation. The question was, how to start?**

Written by George Dodd





The jumbled contents of the coffin of Mer-Neith-it-es before the painstaking investigation process began. Photograph by Stefanie Zingsheim.



👉 When military commander and later Emperor of France, Napoleon Bonaparte, invaded Egypt in 1798, Europe became fascinated by the lavish history of the ancient Egyptian dynasties – so much so that a supply chain sprang up to funnel artefacts and mummies from Egypt to eager European buyers.

At the time, mummies were incredibly easy to come by because there were centuries' worth of mummified nobility to draw on, and commoners as well, naturally mummified by the hot, dry Egyptian climate. You could easily buy them from local street vendors with enough for chic Victorians to host mummy-unwrapping parties. Unsaleable mummies were often used as fertiliser and fuel.

In 1856, Sir Charles Nicholson entered that hectic marketplace as he sailed down the Nile. An English physician who had moved to Australia to join his wealthy shipowner uncle, Nicholson soon gained his own stature and was instrumental in setting up the University of Sydney, where he had many key roles, including chancellor.

Nicholson himself might have described the Egyptian antiquities market in terms of *caveat emptor* ("let the buyer beware"). If you said you'd pay more for a coffin with a mummy, that's what you'd get. But did the mummy belong in that coffin? And was that an actual mummy or a newer body from another source?

Dealing as best he could with the uncertainties, Nicholson put together his collection, which included elements from all over the ancient world, with one goal in mind. He wanted the new settlers in Australia to have a connection with antiquity (the greater antiquity of Aboriginal Australia was not a consideration), so in 1860 he started donating his collection to the University of Sydney, a continuing gesture which eventually added up to more than one thousand pieces. This gift led to the creation of the Nicholson Museum.

"Among the treasures was a particular Egyptian coffin," says Senior Curator of the Nicholson, Dr James Fraser. "When I arrived at the University, a catalogue

from 1948 said it was empty. But no-one really knew what was inside."

An eager archaeologist, Fraser opened the coffin. It wasn't empty. What it contained was, in essence, a mummy, but so torn apart by tomb robbers seeking amulets and jewels and rough handling on its travels from Egypt, that it was a pile of debris packed down one end of the coffin's interior.

"In some ways, this was a good thing," says Fraser. "Unlike in the past, mummies are now treated respectfully, as human remains. A well-preserved mummy shouldn't be tampered with or dissected, so the mummy amalgam found in the coffin was a chance to understand a mummy from the inside out."

The investigation of the remains was still respectful, and for the person charged with sifting through the materials, Dr Constance Lord (GradDipInternatStud '95 BA '92), painstakingly slow. It was also hugely engaging. "You'll never be rich as an Egyptologist," she says. "But you'll also never be bored."

Lord's Egypt obsession started when she was just five, with an art book of her mother's that contained beautiful and other-worldly images from the Tomb of Nebamun. After years of study, Lord is now skilled in forensic Egyptology, which allows her to piece together stories and lives from organic remains including fabrics, bones and soft tissue.

"Poop is my favourite though," she admits. "It's amazing and preserves so beautifully and tells you what their meals were and the medicines they used."

At the Nicholson, Lord focussed on Coffin NMR. 29; the official name of the surprise coffin. The coffin was CT-scanned by Macquarie Medical Imaging, to squeeze out as much information as possible before Lord



1.



2.



3.

1. The mummy remains were crammed down the head-end of the coffin.
2. Endless patience and deep fascination. Dr Constance Lord, Egyptologist.
3. A piece of the coffin discoloured by the preserving resin that had been poured on the body.



went to work. This is how she knew she would at least find various skeletal elements, including ankles and feet, which she was happy to hear. “That meant there might be toenails which are brilliant for radiocarbon dating.”

The first step for Lord and Fraser was to come up with an examination process. They decided to treat the remains as eight sections, which Lord carefully pulled apart one at a time through trial and error, cataloguing even the smallest artefact – the first four sections took six, intense days.

A lot of the material was a dark, heavy dust, so a large sieve was used to reveal bigger elements like pieces of resin (used in the preservation process), wood and human bone. Next a finer sieve found fragments and fibres that were mainly textiles. A final, fine sieve gave a powder that was formed as the textile was slowly destroyed through reacting with the resin.

As it turned out, the toenails were there, but as part of a wrapped and well-preserved package of feet and ankles found at the head end of the coffin. Since the priority is to be as non-destructive as possible, this made the toenails effectively inaccessible. But every other fragment found was a joyful discovery for both Lord and Fraser, particularly the 7137 coloured beads of various sizes, which were a big clue to the status of the person in Coffin NMR. 29.

With all the mummy debris examined, sifted and catalogued, a picture emerged. As mentioned earlier, there is no guarantee that a coffin contains the right mummy, though it seems at least possible in this case. According to the coffin hieroglyphics, the person in NMR. 29 was Mer-Neith-it-es (‘Neith



1.



2.

1. The larger objects from the coffin included human bone, chunks of resin (some decorated) and textile used to wrap the body.
2. All material removed was triple sieved so none of the tiny beads were missed.
3. Many of the tools used by Lord to uncover fragments were the same as those used on archaeological sites.



3.

loves her father’) and the coffin dates to the 26th dynasty at about 600 BC.

The beads were probably part of a mask or decorative net covering the body and they were made of faience; glazed beads that the Egyptians believed were instilled with the energy of rebirth. The beads and her lavishly carved coffin made of expensive cedar tell us we’re looking at a woman of some wealth or she’s from a wealthy organisation. It could be that ‘Neith loves her father’ lived and worked in the temple of Neith.

After being hidden in plain sight for maybe 150 years, Mer-Neith-it-es will soon star in one of the most innovative displays of Egyptian artefacts in the Southern Hemisphere. In February this year, the Nicholson Museum closed its doors, so Mer-Neith-it-es, and all the other treasures of the Nicholson Museum, could move to the new Chau Chak Wing Museum.

“The plans for the museum are incredibly exciting, and visually stunning,” says Fraser. “It’s like technology is delivering an afterlife for Mer-Neith-it-es, after all.” ●

## CHAU CHAK WING MUSEUM

Sydney’s newest museum will open its doors on 26 August 2020. In effect three museums in one, the Chau Chak Wing Museum will house the collections of the Nicholson and Macleay museums, plus the University’s extensive collection of art.

The purpose-built structure will showcase thousands of precious art pieces and artefacts, many seldom seen in the past, due to limited space.

The display rooms will also incorporate the latest museum practices and technologies to give visitors a wonderfully visual and immersive experience.

From ancient Rome and Greece to the art of Aboriginal Australia and the works of leading contemporary artists, the Chau Chak Wing Museum will be open to all as a centre of cultural and artistic excellence.



Kicking up the dust  
means Lord must  
take precautions.  
Photograph by  
Stefanie Zingsheim.





# ON MY DESK: CAMILLA WHITTINGTON



Dr Camilla Whittington (BScAgr '07 PhD (Vet Science) '11), was that kid running around catching insects and experimenting. Her scientist parents were fine with that. Now a scientist herself, she has studied the evolution of platypus venom (she remembers going on her father's platypus field trips), seahorse pregnancy, and shark placentas. She's particularly fascinated by the variety of ways that animals get pregnant and give birth to live babies, including how one species of lizard lays eggs in Sydney, but gives birth to live young up north. And, as she says, "Male pregnancy surprises everyone."

Photography by Maja Baska



### STEVIE THE EDUCATIONAL LIZARD

Stevie's a charismatic and lovely, live-bearing skink, and a rescue animal. She was found in a building basement; she's not native to the area, so no-one knew what to do with her. She used to do a bit of biting, but now she knows humans mean beetle snacks, so she's chill. We use her to demonstrate evolutionary adaptations. She has an amazing spiky tail that's like velcro. It's a great defence mechanism, because if she goes into a crevice, the spikes mean you can't get her out.



### FOSSIL

Fossils aren't really my area, but I was helping my husband collect animals in southwest Queensland – he's also a researcher. Looking for night-time amphibians meant the days were free, so we went fossil hunting. The place is famous for fossils. You can buy a fossil fossicking license for five dollars then go to an old quarry and spend an hour looking through the rocks. Finding this fossil was super cool. It's some kind of extinct fish, though the teeth are a little loose.



### GRANDMOTHER'S FAMILY CREST

I've been interested in seahorses for a while. In fact, for my postdoc, I went to Switzerland to study male pregnancy in seahorses – though the seahorses were actually Australian. Then I found out that the Scottish family crest of my grandmother just happens to be a seahorse. There's a research seahorse colony here at the University; one of the very few in the world.



### 'WOMEN IN SCIENCE' AWARD

This brought me my first grant, post-PhD. It made a massive difference, seeding all the funding since then. The Women in Science Fellowship aims to kickstart your career and you can propose anything. I wanted to look at pregnancy and the placenta of sharks. Talking about what we do, figuring out how unusual critters reproduce, can capture the public imagination, which hopefully brings home the idea of conserving our biodiversity.



### WOOD-TURNED DNA BOWL

Emeritus Professor Mike Thompson is an amazing zoologist who used to work here. He's one of my mentors, and I've inherited his office. He'd say his hobby was making sawdust, but he actually does these beautiful, wood-turned bowls. He made this as a wedding present. He said, "You both do zoology, and DNA is what makes an organism tick."



### SHOE RACK

I work in the lab in comfortable shoes, so I keep a selection of dressier shoes here for meetings. The purple gumboots are for the lab because it gets pretty wet in there. Being dressed for something more formal later, but wearing the purple gumboots during the day – this does get comments.



### THE LAB BOOKS

I should use an electronic lab book, but the lab isn't very laptop friendly, particularly when I'm splashing water around aquaria. So, I still write on paper. These books have all our experiments in them, all the data. They are a great record of the fantastic work that my students have done. Of course, we scan and upload the pages for backup.





Professor David Reilly in the quantum computing laboratory at the Sydney Nanoscience Hub.



# CHAMPING AT THE BIT

Written by  
George Dodd

Photography by  
Louise M Cooper

The challenges are so enormous there are quantum computing sceptics who doubt the technology is even possible. That only makes the advances happening at the Sydney Nanoscience Hub even more remarkable.







A dilution refrigerator used to cool quantum devices to near absolute zero. The gold elements reflect radiation and give high thermal conductivity. The structure at the bottom (with three blue wires) is a cryogenic quantum control platform for manipulating qubits.



👉 It's been said that quantum computing will be like going from candlelight to electric light in the way it will transform how we live.

Quite a picture, but what exactly is quantum computing? For the answer to that question, we'll have to visit a scale of existence so small that the usual rules of physics are warped, stretched and broken, and there are few layperson terms to lean on. Strap yourself in.

Luckily, we have a world-leading researcher in quantum computing, Professor David Reilly, to guide us.

"Most modern technologies are largely based on electromagnetism and Newtonian mechanics," says Reilly in a meeting room at the University's Nano Hub. "Quantum computing taps into an enormous new area of nano physics that we haven't harnessed yet."

With his youthful looks and laid-back demeanour, Reilly isn't how you might picture a quantum physicist. He has five Fender guitars (with not much time to play them), and a weakness for single malt Scotches.

That said, science has never been far below the surface. As a child, he would pull apart flashlights to see how they worked. During his PhD years, knowledge was more important than sleep; he often worked past 3am to finish experiments. "Sometimes you'd be the only person in the world with this new piece of knowledge. It's a pretty wild feeling."

A good place to start the quantum computing story is with the humble transistor, which is simply a switch that allows, blocks or varies the flow of electricity, or more correctly, electrons. Invented in 1947, it replaced the large,

energy-hungry vacuum tubes in radios and amplifiers, also finding its way into computers. This off/on gate effect of transistors is the origin of the zeroes and ones idea in traditional (aka classical) computers.

Ever-shrinking transistors are also how computers have gone from room-filing monsters to tiny devices in our pockets – currently, just one square millimetre of computer chip can hold 100 million transistors. Incredible, yes, but also unsustainable. With transistors now operating at the size of atoms, they literally can't get much smaller, and they're now at a scale where the different, nanoscale laws of physics are warping and compromising their usefulness.

"At that scale, an electron stops behaving like a ball being stopped by the transistor gate," Reilly says. "It's more like a wave. It can actually tunnel through or teleport to the other side, so the on/off effect is lost."

Quantum computing seeks to solve this problem, but it also promises a great leap forward.

It's based on the idea that transistors can be replaced by actual atomic particles where the zeros and ones aren't predicated on the flow or non-flow of electrons, but on the property or energy state of the atomic particle itself. These particles can come from various sources (and are usually engineered in nanoscale devices) but they're called collectively, qubits.

Now things get trickier. Yes, trickier. Where a transistor can be either one or zero, it's a weird fact of quantum physics, that a qubit can be one or zero at the same time, like a spinning coin that holds the possibility of both heads and tails. For a single qubit, this doubles the one-and-zero mechanism. And for every qubit added, the one/zero combinations increase exponentially.

**"SOMETIMES YOU'D BE THE ONLY PERSON IN THE WORLD WITH THIS NEW PIECE OF KNOWLEDGE. IT'S A PRETTY WILD FEELING."**

— David Reilly



It is envisaged that quantum computers could have billions of qubits, representing phenomenal computing power.

That's very broadly the theory, but what currently keeps Reilly up at night is how to build the machinery that will allow the theory to impact the real world. This machine would need a mechanism for manipulating the state of the qubits and a way of inputting and outputting information. As an added challenge, to make it all controllable, the machine would have to operate at minus 273°C, just a shade above absolute zero.

"How to do all that is technically and fundamentally challenging. There are big scientific questions, big engineering questions, but that's what we do here," Reilly says, unflustered.

The quality of the work happening at the Hub was powerfully endorsed in 2017, when the Microsoft Corporation proposed a research partnership with the University, one of only four such arrangements Microsoft has in the world.

"This is not a research grant," Reilly says. "Microsoft have been working in quantum computing since 2005 and they're in it for the long haul. Now we're working together, elbow to elbow in the labs, on something where every part is a work in progress. It's a partnership advancing a frontier."

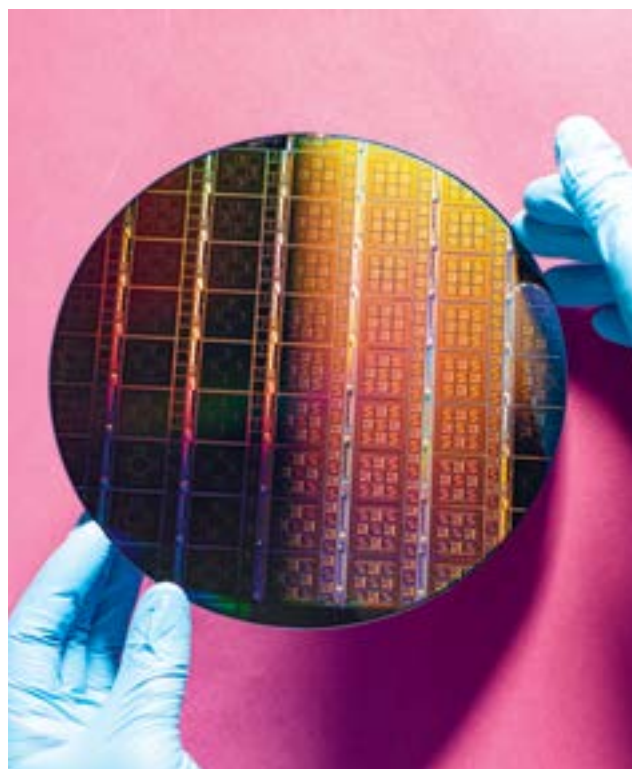
Reilly's role sees him straddling the corporate and the academic, where deep knowledge is important but always with the goal of creating something real. Remembering how even great work can vanish into academic papers, Reilly says, "The thought of not knowing whether this technology can come alive, I find to be scary. Connecting the discovery bit to the industry engineering machine means you actually see the whole system come together. That's exciting."

So, where might quantum computing be put to work?

The first thing to know is that our classical computers will not disappear from homes or offices. Quantum computers work on a scale well beyond emails, video games and spreadsheets. They will be about hugely accelerating global research and production.

**"MICROSOFT HAVE BEEN WORKING IN QUANTUM COMPUTING SINCE 2005 AND THEY'RE IN IT FOR THE LONG HAUL. NOW WE'RE WORKING TOGETHER, ELBOW TO ELBOW IN THE LABS."**

— David Reilly



Superconducting electronics, where electrons can travel with much less resistance, are created using nanoscale lithographic patterning techniques in the Sydney Microsoft facility.

"If you look at the top 10, classical-type super computers on the planet right now, you'll find some are doing defence applications, like simulating weapons," Reilly says. "But a big chunk of them, are renting time out to pharmaceutical companies to understand the basic chemistry of different types of drugs which is really complex stuff."

These are the areas – industrial chemistry, pharmaceuticals, climate, city planning – where quantum computing could bring unimagined speed and accuracy, and the possibility of much more.

"Go back to the invention of things like the transistor and you'll see that humankind's ability to imagine what a new technology might do in the longer term is pretty poor.

"Likewise, this new physics promises new technology," says Reilly. "And chances are, it will be revolutionary." ●



Written by  
Rebekah Hayden

Photography by  
Louise M Cooper

# Something in the air

**By the time a farmer sees a disease outbreak in their crops, devastating financial and environmental consequences might already be unavoidable. If only it was possible to detect a plant pathogen before real damage was done. Well, now it is.**



🔥 In 2015, a farm in the heart of Australia's largest banana region had an outbreak of a destructive soil-borne fungal infection called Panama Disease. For banana growers, this disease is up there, crisis-wise, with bird flu and Ebola. With far north Queensland accounting for 85 percent of Australian banana production, it was a terrifying moment for the industry.

Panama Disease, aka *Fusarium oxysporum* f. sp. *Cubense* tropical race 4 (TR4), or Fusarium wilt to its very few friends, struck Australia in 1997 when an outbreak in the Northern Territory decimated commercial banana growing in the region.

The disease is a formidable foe, but new technology from a team of enterprising engineers, who met as students at the University of Sydney, is set to help farmers detect, map and eradicate it before it spreads.

In classic superhero tradition, the squad of four is a super nerdy, diverse bunch of high achievers, each with a distinct set of strings to their bows, aside from engineering.

Saron Berhane is a microbiologist (and event coordinator and photographer); Lewis Collins is proficient in robotics, mechatronics and biomedical engineering (he also hikes and has a drone obsession); Henry Brindle (BE(Hons) '19 BCom '19) is a mechanical and hardware engineer with a collection of self-built 3D printers; and Josh Wilson (BSc '18) BE(Hons) '18) is a computer scientist, engineer and mathematician, who solves complex computer science and maths problems for fun.

With such an embarrassment of skills, it's little wonder their plant disease-detecting brainchild, BioScout, hit the ground running, with the test deployments starting in July 2017,

and commercial installations from April 2019, only three years after development began.

The BioScout platform consists of patented sensors that suck in air and analyse spores and other airborne particles onsite, with alerts sent to the farmer via text message. An online dashboard shows atmospheric conditions and disease patterns in real time across farms or whole regions, so the farmer can make decisions about when and where to spray.

"So, a farmer can say, its 27 degrees, 90 percent humidity and there's a spore load that's increased over the last two days. If I don't spray right now, we're going to have a disease outbreak which is going to be very severe," says Collins.

BioScout had a major coup earlier this year, when the team secured a trial with one of the major banana growers in Far North Queensland. The trial is



**Lewis Collins**

**DEGREE**  
BE(Hons) '17

**MOST PRECIOUS POSSESSION**  
A box of letters that I've collected over my life.

**BIGGEST LIFE INFLUENCE**  
My parents.

**FAVOURITE MUSICIAN**  
Bob Dylan.

“THERE'S THIS HUGE DIGITAL REVOLUTION HAPPENING. BUT THERE'S A GAP IN WHAT'S HAPPENING IN THE AIR AROUND US, IN THE DISEASE BASE. WE'RE HOPING TO ANSWER THAT PART OF THAT EQUATION.”

— Lewis Collins, BioScout CEO



in a district where four other farms are infected with the previously mentioned Fusarium wilt, which spreads by root contact and by fungal spores in soil and water. This means their banana-grower client is on constant high alert for outbreaks, with stringent biosecurity measures and monitoring.

During a three-month trial covering a 15-hectare test plot, BioScout's constant monitoring meant four fewer sprays were done. A generalised reduction in spraying like this could dramatically reduce the chemical load in the environment, and indeed, in the crops produced. It would also mean a significant cost savings for the farmer. Usefully, the sensors can also indicate if a spray has been ineffective, allowing the farmer to spray again to retain a higher yield.

"This is the last digital frontier for agriculture," Collins says. "You can

already look at soil moisture and use irrigation, and tractors can drive themselves – there's this huge digital revolution happening. But there's a gap in what's happening in the air around us, in the disease base. We're hoping to answer that part of that equation."

During his studies at the University, Collins was working on a PhD about how to detect the spread of wheat rust using drones and unmanned aerial vehicles, when he was joined by honours students, Berhane and Brindle, in 2017.

Berhane remembers how well they complemented each other. "We were basically working on different aspects of the system. I was looking at the healthcare application and building the analysis hardware, while Henry was looking at the actual sensor unit and how that would be mechanically engineered to detect pathogens and spores," she says.

Founders of BioScout,  
(L-R) Lewis Collins, Saron  
Berhane, Henry Brindle  
and Josh Wilson, with new  
team member and current  
student, Jesse Morris.





“Halfway through that year, we realised this sort of technology doesn't exist anywhere on the market. The only thing close to it was about 50 years old and hadn't been changed or updated in that time.”

Crucial to their success has been the business development programs they undertook. In 2018, they completed both the University of Sydney's Incubate and Inventing the Future programs and took part in the very competitive national Startmate Accelerator in 2019.

The programs helped the BioScout team rapidly apply their research to different markets, as well as building business skills and providing an opportunity to meet top venture capital firms, funders and farmers. Collins and Berhane also had to develop their public speaking skills, as large-scale presentations can be an important part of the process. Meeting prospective clients was also of huge value.

“After talking to farmers and agronomists, we realised that drones aren't quite ready for mass deployment in agriculture because you need a pilot's license to fly them and you can't fly beyond the line of sight. So we actually pivoted the technology to what it is now: a static unit that sits on a rotating axis on a pole. It's such a good example of pivoting that they actually now teach it at the Business School,” Collins says.

BioScout is seeing healthy growth, with three farms taking on the technology this year alone, and another 29 farmers in Australia and three in the United States keen to deploy the technology in 2020. The team are currently looking to raise funds so they can commercialise the technology further and ultimately make BioScout ready for scaling up.

“From idea to even starting to commercialise takes the average piece of agricultural technology 10 years. So, farmers are always surprised that our turnaround was so quick. For me, it's a great chance to show that the University and students can work together to build something pretty amazing,” Collins says.

With the BioScout able to analyse thousands of airborne particulates like pollen, microorganisms and environmental toxins, a plethora of healthcare applications for hospital-acquired diseases, asthma, allergies and disease management looks likely in future.

It's still early days, but the fast uptake of the BioScout technology shows that when good ideas and great research are developed hand-in-hand with end users, world-shaping outcomes are possible. ●



## Saron Berhane

### DEGREE

BE(Hons) '18

BMedSc '18

### WHAT ELSE YOU MIGHT HAVE BEEN

A pilot.

### FAVOURITE CHILDHOOD TV SHOW

*Play School* and  
*Horrible Histories*  
(Can't choose one!)

### PROUDEST MOMENT

Hearing my parents cheer me at my graduation ceremony  
- it reminded me of the sacrifices they made leaving war-torn Ethiopia and moving to Australia.



The BioScout device is designed for agricultural settings, but it could have future applications in medical environments.



# How it works

The air is drawn in and air particles adhere to a sticky strip. Through automated microscopy, the particles are photographed then, through an artificial intelligence function, the particle photos are compared to a database of pathogen images. If the AI finds a match, BioScout sends a text alert to the farmer's phone.

## Energy

In sunless weather, a battery takes over from the solar panel. It can run for a week in 'energy save' mode.

## Wind vane

Controlling the direction of the sensor inlet, the wind vane enhances spore capture.

## Coverage

Devices cover 25 to 100 hectares. In flat, broadacre fields (wheat, barley, canola), spores can travel longer distances, so only one device per 100 hectares may be needed. For horticulture crops (tree nuts, fruits, vegetables) with dense canopies, it's harder for spores to travel, so a device density of one or more per 25 hectare is recommended.

## Pole

The mounting pole can be adjusted up or down to maximise capture efficiency with crops of different heights, from tall avocado trees to lower strawberries. The guy-wires maintain stability.

Airborne particles

Pathogen

Dust

5 - 30µm

## 1. Disease particles

Spores, pollen and other biological particulates are funnelled into the capture inlet, where they're caught on an adhesive surface. Filtering out dust and other larger particles minimises interference and false positives.

## 2. The alert text

This tells the farmer which of the farm's devices detected the pathogen, which field is affected, what the infection is, and the predicted severity.

## 3. Dashboard

The full BioScout dashboard can be viewed on a laptop. It displays a map of the farmer's property, showing the location of the devices, all current pathogen warnings and weather information.

BioScout devices

Spray

## 4. Farmer response

By knowing infection locations, farmers can target their spraying. This means fewer chemicals in the environment, reduced crop losses and savings in both time and money.





Dr Dan Penny with  
core samples, in the  
Geosciences Marine  
Wet Sediment & Core  
Analysis Laboratory.



**Built using a thousand elephants and 300,000 labourers, the opulent temple city of Angkor has been near-deserted for centuries, yet its grandeur and mystery now attract a million visitors each year. The question is, why was it deserted at all? An answer is finally emerging.**

🔥 In the basement of the University's Madsen Building are archives of Cambodia's environmental history, including, in a cool room, dozens of drill cores that were extracted from the city of Angkor. These drill cores have seen scientists reconsider the downfall of the world's largest pre-industrial city.

Taken from just two metres beneath the earth's surface, the cores tell the story of how land at Angkor has been used over thousands of years. "Their layers are like pages in a book," says Associate Professor Dan Penny from the School of Geosciences.

"Once we bring a core home from Angkor and split it open, going back through each of those pages is like going back through time," he says, his detailed descriptions conveying a deep knowledge of this ancient city, one he has explored for more than 18 years.

Angkor was the capitol of the Khmer empire from around AD 800 (the word Angkor means 'city', while Angkor Wat means 'city of temples'). Established for its proximity to water, fish and arable soil, Angkor is rightly famed for its water management system that controlled the variability of the water supply through a complex network of moats, canals and reservoirs.

# KNOWING THE DRILL

Written by  
Jocelyn Prasad

Photography by  
Louise M Cooper



Over five centuries, Angkor grew to cover more than a thousand square kilometres, comparable in size to modern day Los Angeles, though with a much lower population density.

The accepted view has been that Angkor collapsed suddenly in 1431, following an invasion by inhabitants of the powerful city of Ayutthaya, in modern day Thailand. Penny and his colleagues put this theory to the test when, in 2016, they took a dozen drill cores from the earth beneath Angkor's temple moats.

From these cores Penny extracted microscopic evidence of past environmental change. In particular, he examined pollen grains from plants and charcoal derived from residential fires, while also measuring rates of erosion and sedimentation.

"We were looking for what people were doing in the landscape. How they used fire, how plants were changing, when occupation was intense and when it decreased," he says. "We certainly didn't find evidence of the sacking in 1431, and a sudden abandonment of the city. It was instead a very prolonged diminution in the commercial and ritual core of the city."

Penny's findings suggest the central city elite left Angkor gradually, attracted, perhaps, to the better located and more profitable trading centres on the Mekong Delta.

Additional evidence provided by ancient tree rings suggests climatic variation may have been the nail in the coffin. Tree ring cross-sections taken from long-lived conifers indicate a major drought in Angkor towards the middle of the 14th century, followed by intense monsoons and then another big drought.

"The problem was not drought or flood, but variability between both," Penny says. The collapse of the water network – due to a combination of intense summer monsoon rains and

lack of maintenance – likely hastened the city's desertion.

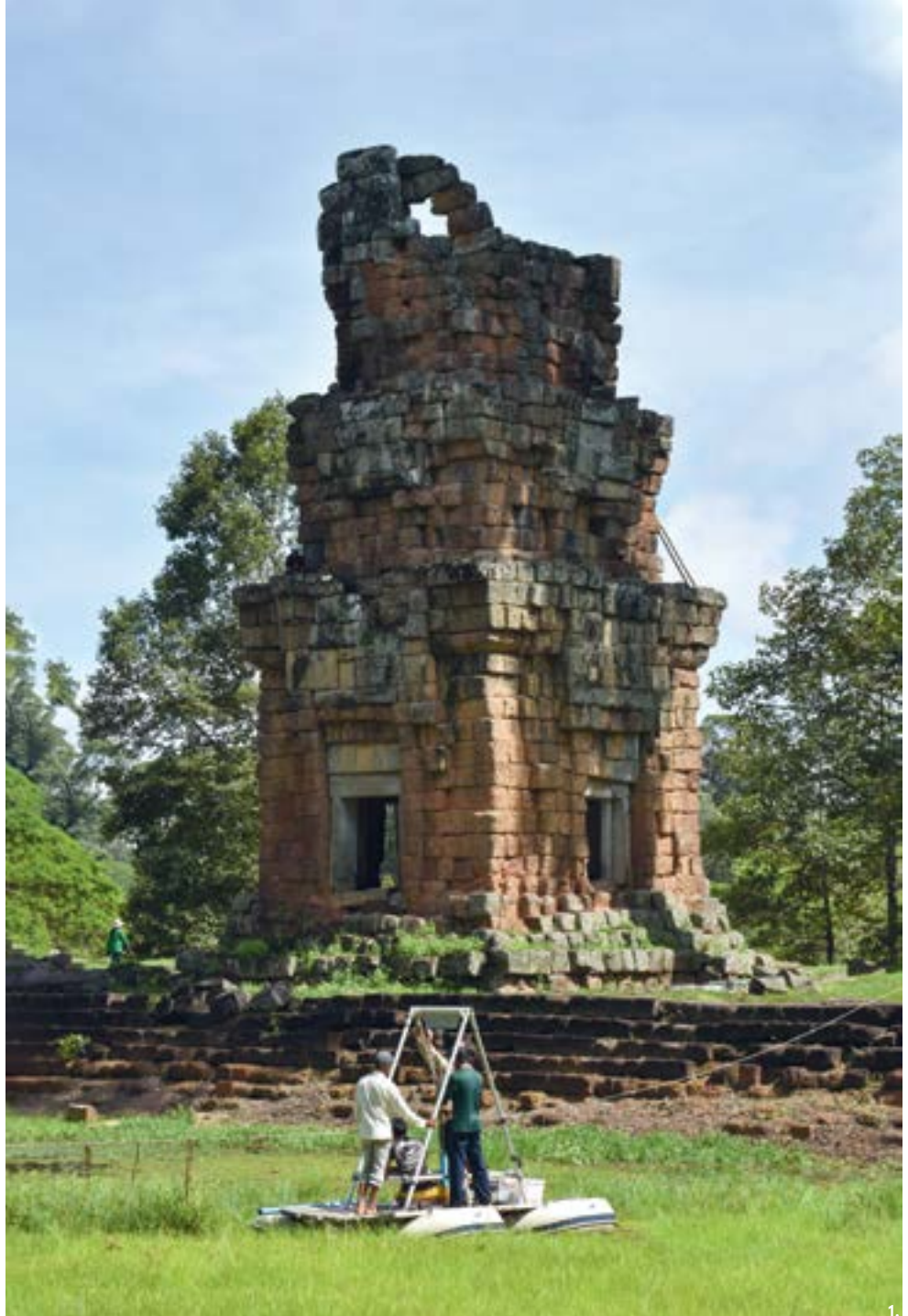
Penny began looking at Angkor as a postdoctoral researcher in 1999, and soon began collaborating with archaeologist Roland Fletcher. Now a professor, Fletcher was at Angkor exploring questions about urbanism and the demise of cities. Penny was researching environmental change at pre-Angkor sites along the Mekong Delta. Their skills were perfectly matched to explore the rise and fall of Angkor.

"It's not a purely urban story, nor is it a purely environmental one," says

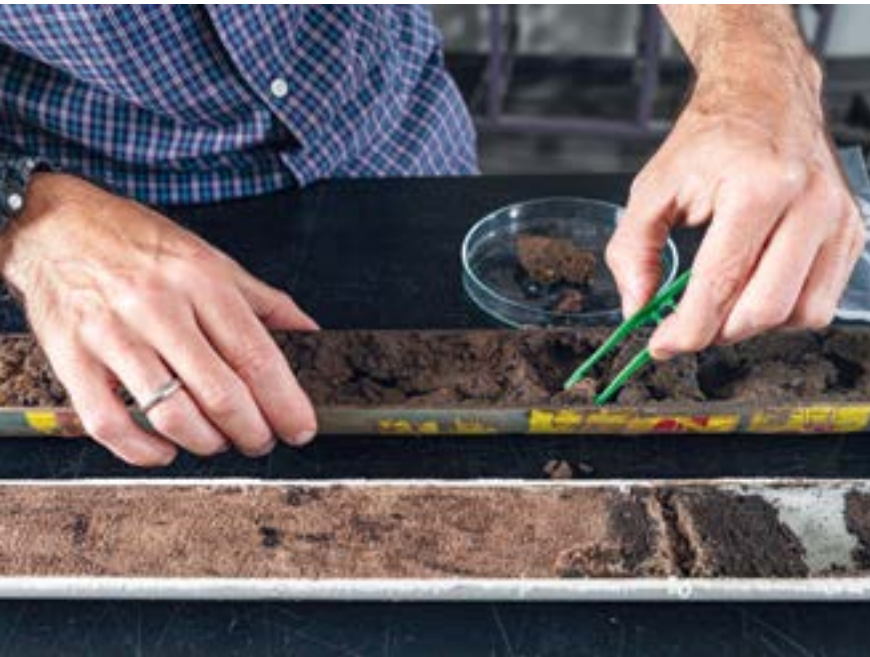
Penny. "It's a mixture of the two."

Penny returned from Edinburgh University to join the University of Sydney in 2001. Along with Fletcher, he is now a director of the Angkor Research Program, which brings together academics from across the University to better understand this once great city. Rather than focus on the monuments, the program delves into "the stuff that's no longer there".

"We're interested in what goes on between the monuments. We're interested in water, in forests, in soils," all of which draws on Penny's skills in paleo-botany and sedimentology.







“More than half of humanity lives in cities, so understanding the fundamentals of urban resilience in the context of climate change is very important.”

— Dan Penny



1. On a floating platform, Penny and team take a drill core sample from an overgrown reservoir. The 12th century tower S1, of the Prasat Suor Prat group, looms in the background. Photograph: Dr Martin Polkinghorne
2. Split sediment cores reveal layers of history. In the petri dish are ceramic fragments, sometimes found in these environmental archives.
3. Sediment samples, labelled and bottled, await analysis.

case of the Khmer people, the decline of Angkor saw their society transform from one huge agrarian kingdom to become much smaller trading cities along the Mekong Delta.”

As Penny’s work continues on these so-called middle period cities on the Mekong Delta, his team is also exploring the collapse of civilisations in the Maya territories of Belize, Mexico and Guatemala. Happening at the end of the first millennium, the collapse of the Maya was also triggered by drought. In his Central American work, the focus is on cities that survived.

“What is it about these cities that makes them able to survive the profound changes in climate, whereas cities only tens of kilometres away were destroyed or abandoned?” he asks.

Penny does field work in the tropics of Asia and America every year to collect drill cores. Back in Sydney, he spends much of his time in the laboratory or at the microscope set up on his desk, surrounded by slide boxes, methodically examining every sample. While this kind of scientific work takes patience, what Penny does is laced with moments of pure satisfaction, like finding a pollen grain from a crop plant that someone tended 900 years ago.

“Those connections to places and peoples that are long gone are really exciting.” ●



**Dan Penny**

#### OCCUPATIONAL HAZARD

Leeches. They engender a visceral, taping-the-trousers-shut sort of horror.

#### MOST PRECIOUS POSSESSION

None of my precious things could be described as possessions, but I am fond of my coffee machine.

#### QUALITY YOU MOST VALUE IN OTHERS

Dry wit.

Why is this important? There are a number of cases, particularly in the tropics, where large, low-density cities failed at least partly because of stress generated by climate variability, Angkor among them.

“That rings quite significant alarm bells because we are moving into a century full of climate variability and more frequent climate extremes,” says Penny. “More than half of humanity lives in cities, so understanding the fundamentals of urban resilience in the context of climate change is very important.”

Penny points out that when we talk about the collapse of societies, we see it as an end point.

“But it isn’t an end point for its people,” he says. “It’s part of a transformation as populations adapt to changing environments or circumstances. In the



A close-up photograph of a person's face, focusing on their eye. The eye is looking slightly to the right, and a reflection of a wind turbine is visible in the iris. The background is dark and out of focus.

# It led me to help companies go green.

**Amira Hashemi**  
Master of Sustainability

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THE UNIVERSITY OF  
**SYDNEY**



**Being a teenager is more complicated than it's ever been. With so much cultural white noise, many young people fail to learn key life skills or recognise the positive qualities within themselves. The Helmsman Project aims to put them back on an even keel.**

# A tight ship

Written by  
Lauren Sams (BA(Hons) '07)

Photography by  
Louise M Cooper



👉 He was without fail, the rowdiest kid in every classroom, but during the Helmsman Project group camp, he went on a 45-minute walk where no-one had phones, and no-one was allowed to talk. After the camp, this rowdy kid said the silent walk was the thing he liked best.

“He loved it. All the kids do,” explains the Helmsman Head of Programs, Dr Charmaine O’Brien. “Which says a lot about the lack of quietness and reflection in their lives.”

The Helmsman Head Coach, Matthew Robinson, points out how technology plays a big part in this. “A lot of these kids are constantly curating their images on social media,” he says. “And if you don’t get 100 likes on every post, what does that say about you? To have that pressure taken away must be an amazing sensation.”

So, what is the Helmsman Project? It’s designed to help Year 9 students from disadvantaged backgrounds to see beyond themselves and reach their full potential. And despite the silent walks, the program is anything but low-key and introspective. It is highly active, with an outdoor adventure camp as one of its key elements.

This is a familiar scenario, particularly for students in more advantaged schools, but the Helmsman adds another layer to this ‘adventure education’ that makes it unique.

“We don’t just throw them in the bush for a week as a confidence booster,” says Robinson. “Our program coaches guide them in reflecting on the experience both before and after it happens, so the kids are getting as much out of it as possible.”

O’Brien and Robinson have very different energies; she more reserved, he more animated. But they share a strong sense of purpose in what they do for the kids. “We both know how important equitable opportunities are,” says O’Brien. “And we want to help these students develop the skills they need to get them.”

The Helmsman approach is based in a relatively new category of evidence-based psychology called coaching psychology. The University of Sydney

was first in the world to offer it as a master’s course and both O’Brien and Robinson are graduates. Coaching psychology had a particular evolution.

“These days, medicine does more than just heal the sick. Medical principles now help athletes become better at their sports,” explains Robinson. “Coaching psychology is the same idea. We use a variety of psychological principles and tools developed in the clinical space, but we apply these to help people who are fine but want to make more of what they have.”

The founders of the Helmsman Project, Andrew Stainer (MAppSc(PsychCoach) ‘12) and John Naylor (MOrgCoaching ‘13), met at the University while doing the coaching psychology course, setting up the project in 2010. Naylor, who is a master yachtsman, named the organisation for the person who steers a ship. As O’Brien explains, “It’s about the point where you move from being a child to becoming an adult. You learn to take the ‘helm’ of your own life.”

The founders are no longer directly involved, but the Helmsman Project continues to guide and encourage young people, supported by government grants and public donations. “We look for the kids who are coming to school but not meeting their potential,” says O’Brien. “They’re not necessarily struggling, they just lack motivation and maybe some social skills.”

In the five years since it began full operations, more than 439 students have experienced the program.

The process starts with representatives from the Helmsman visiting schools (currently in western and south-western Sydney, but expansion is planned) to recruit Year 8 students for the following year. The school helps identify those who might benefit most and encourages them to join. “The kids have to choose to be part of the program. They have to want to do it for it to be effective,” says O’Brien.

The eight-week program matches students to volunteer coaches who help them understand the



**Matthew Robinson**

**DEGREE**  
MScPsychCoach ‘18  
MTech ‘02

**THE THING YOU NEVER WANT TO DO AGAIN**  
The HSC.

**FAVOURITE CHILDHOOD TV SHOW**  
Monkey!

**QUALITY YOU MOST VALUE IN OTHERS**  
A love of books.

**“It’s about the point where you move from being a child to becoming an adult. You learn to take the ‘helm’ of your own life.”**

— Charmaine O’Brien





←  
In Ghana, Rader Antwi was told by her high school teacher she'd make a 'great housewife'. On her first Helmsman trip, she couldn't swim but had to climb around the ship's front. "It was so, so scary," she says. "But everyone was really encouraging. I thought, 'Oh, this is what support feels like'. It can make you overcome fears." Antwi went on to become a school prefect and go to university.





Charmaine O'Brien (L) and Matt Robinson. They have seen that even small changes in a young person's attitude can lead to big changes over time.

emotions they experience during the various activities (so far, 39 of those coaches have been University of Sydney graduates). They also guide them towards other ways of thinking about those emotions and how they perceive other participants.

While one aim is to challenge the students with planned physical activities (some students are so unfit, even walking a short distance is a trial), the more significant challenge can be mixing in with the 40 or so other students on the camp. For teenagers, connection with peers is critical to wellbeing, but the necessary social skills might be underdeveloped.

For cultural reasons, some kids are expected by their parents to study and nothing else – two students joined the program just to spend some time outside. Others, particularly girls, find themselves taking over home duties during their teens, which keeps them isolated within their families. And again, technology plays a role in limiting opportunity.

"Many kids have devices that allow them to access everything they think they need from their bedrooms," says Robinson. "They might be communicating with people they know, but they're also alone and don't actually learn the nuances of human interaction."

"We create challenges that demand collaboration and social skills. The camping is part of it – putting up tents, taking them down, preparing meals. Some of the kids have never cooked and it's really exciting for them to do it."

The other key element of the program is a community project that the students design, develop and implement themselves. This can be an eye-opener, making them aware for the first time of bigger issues like homelessness and the social isolation of older people.



Robinson describes part of the process. "Depending on their chosen project, we might say 'let's research local aged care facilities and come up with at least three places where we can offer to help'. Then we tell them they have to call those places."

The kids collaborate on a script for the call. "That's always fun to watch," says Robinson. Then one of them makes the call, often on speaker phone so the whole group can hear it."

"Some of these kids have never spoken to a stranger on the phone before," says Robinson. "So, they're learning all that social etiquette."

Research funded by the Australian Research Council (ARC), has shown significant benefit for students who have participated with the Helmsman Project, particularly in developing the so-called 21st century skills like teamwork, resilience and leadership. It also shows that participants who come from further back flourish the most.

"The Helmsman kids at one school did a presentation where one of them confidently talked to a group about the experience," says Robinson. "Afterwards the principal said, 'I nearly fell off my chair. I've never even heard that student speak before.'" ●



**Charmaine O'Brien**

**DEGREE**  
MScPsychCoach '15

**PROUDEST MOMENT**

Having someone tell me my writing changed their life.

**FAVOURITE AUTHOR**

Just one? Canadian/ Indian author, Rohinton Mistry.

**QUALITY YOU MOST VALUE IN OTHERS**

Confidence to ask for what they need.



# Sobering thought

Written by  
George Dodd

Photography by  
Louise M Cooper

Recent studies show that up to 60 percent of Australian women have consumed alcohol to some degree during pregnancy. Elizabeth Elliott knows only too well the dangers of Fetal Alcohol Spectrum Disorder, and her advice is clear: **party over**





👉 The warning poster was funded by the alcohol industry as part of a harm minimisation campaign. The big print message wasn't exactly assertive, but it was fine: "It's safest not to drink when pregnant." The problem was the small print.

On 2400 posters to be distributed to hospitals, GP clinics and health groups, the small print said, "It's not known if alcohol is safe to drink when pregnant."

Saying that the science isn't settled is a classic gambit used by tobacco companies and climate change deniers, and now, apparently, the alcohol industry. Elizabeth Elliott bristles at the very idea. "Fetal Alcohol Spectrum Disorder (FASD) entered the mainstream medical literature 40 years ago," she says. "It is a very real disability affecting babies around the world. Wouldn't you think they'd have got the message by now?"

Warmly engaging but direct, Elliott also has a quality of quiet patience that has no doubt helped in her many battles. The message she brings is simple: don't drink alcohol if you're pregnant. Getting it heard and understood has been much harder, with Elliott devoting 20 years to the task.

The uncomfortable truth for a booze-loving nation is that alcohol easily passes across the placenta, so an unborn child will share every alcoholic drink its mother consumes. More often than most people realise, the result is FASD, where alcohol interferes with the development of the fetal brain.

"I'm asked all the time how much is safe to drink?" says Elliott. "Alcohol affects people in different ways due to genetics and other factors. How the fetus deals with alcohol is different again. There is no one-size-fits-all when it comes to predicting risk."

That said, when drinking happens, it can change outcomes, though not for the better.

In the first trimester, when the baby's body is forming, alcohol can damage the brain and other organ systems and may leave visible signs: a small head, small



## Elizabeth Elliott

### DEGREE

MBBS '80 MD '92  
MPhil PHlth '09

### FAVOURITE CHILDHOOD TV SHOW

We had no TV till I was 12  
- but I did become an  
avid fan of Enid Blyton.

### MOST ADMIRER PERSON

My husband, for the  
difference he makes to  
children with intellectual  
disability and psychiatric  
disorders.

### HIDDEN TALENT

Usually lucky with a  
fishing rod, but most  
sports apply.

wide-set eyes, a very thin upper lip and birth defects. The child may be born small and grow poorly.

In second or third trimester exposure, when the body structures have already formed, the visual clues of alcohol harm are missing, but damage to the brain later expresses itself through a spectrum of learning problems and behaviours, including poor attention and memory, impulsiveness, and problems with cause-and-effect reasoning.

Longer term, people with FASD may face serious problems at school, unemployment and homelessness, with an average life expectancy of just 34 years, the leading causes of death being suicide, accidents and substance abuse. In the Western Australian Juvenile Detention Centre, a third of young offenders had FASD. There is no treatment. Only prevention.

When you consider that female drunkenness is now more common and accepted than it used to be, with the alcohol industry aggressively targeting young women, and that around 50 percent of pregnancies are unplanned, FASD should be more prevalent than the numbers suggest. And maybe it is.

"Many educated and prosperous women drink a lot of alcohol," says Elliott. "It's unrecognised that many of their children were exposed prenatally. When it comes down to diagnosis, autism or attention deficit hyperactivity disorder may be more acceptable than FASD – acknowledging the symptoms of FASD but not the underlying cause."

FASD first came onto Elliott's radar 25 years ago when she set up the Australian Paediatric Surveillance Unit, a national rare disease surveillance system, where paediatricians submit monthly reports of rare infections, injuries and genetic disorders. Still ongoing, it's been a springboard for wide-ranging research and some of the earliest Australian work on FASD.

This surveillance system is just one element of what is now a lengthy and impressive CV for Elliott, marking numerous leadership roles and awards; and to think, Elliott once thought she'd be an architect. Over the years, Elliott has tried to take on any project she saw as worthwhile. "It adds to workload and stress, but things like the Australian Human Rights Commission's work with refugees on Christmas Island have been so rewarding. Most rewarding has been my work with Aboriginal people."

While mainstream Australia has been slow to grapple with FASD, and the alcohol industry only half-hearted

# “MANY EDUCATED AND PROSPEROUS WOMEN DRINK A LOT OF ALCOHOL. IT’S UNRECOGNISED THAT MANY OF THEIR CHILDREN WERE EXPOSED PRENATALLY.”

— Elizabeth Elliott

in flagging the dangers (the industry recently claimed that putting warning labels on their products would cost a wildly unlikely \$600 million to no effect), Aboriginal Australia has been determinedly tackling the problem for some time.

Thanks to her FASD experience, in 2009 Elliott was invited to Western Australia’s Fitzroy Crossing in the Kimberley region. She clearly remembers the deep dryness, the red earth, and the friendliness of the people.

“I went to women’s bush camps where women would come in from 45 remote communities all over the Fitzroy Valley,” Elliott explains. “They’d camp for a few days, the kids would play, and the women would talk about the important issues. That’s how the alcohol restrictions came to these communities. That’s how the FASD study came about.”

With men often out of the picture because of alcohol or illness, it was women who stepped up when they noticed children being born with particular features, who struggled at school. With so many smart and determined women thinking about FASD solutions, Elliott has often been shocked by how governments respond. “I’ve seen it myself, their opinions are often dismissed, funding withheld, and projects fail.”

The Kimberley women knew that talking about FASD in their communities might attract unhelpful attention and judgement, but they were aware of an important reality: as far as the government is concerned, no data, no problem.

Working closely with the community over 10 years, Elliott has witnessed an Aboriginal-led transformation. After proving that FASD affected one fifth of children and was the source of tremendous damage, the Fitzroy Valley now has FASD education, a new child and family centre, family violence centre and positive parenting program and has resisted challenges to alcohol restrictions. Importantly, fewer women drink in pregnancy.

Though FASD was once a largely hidden or unacknowledged condition, Elliott has worked hard to turn the tide. She has chaired the National FASD Technical Network to advise government, co-directs the NHMRC

Centre of Research Excellence in FASD, established a NSW FASD assessment clinic, led development of a national FASD website and register, and contributed to Australian and WHO alcohol guidelines and a US drive to standardise diagnostic criteria.

Asked if a thread runs through her wide-ranging career, Elliott pauses for a moment, then says, “Social justice. We have a tremendously sophisticated medical system here – we can save children’s lives. Yet right in front of us are kids who are medically disadvantaged: in Aboriginal communities, immigration detention, juvenile justice. They have a right to health. I’m just trying to advocate for them.” ●

June Oscar AO (left), is a Bunuba woman from Fitzroy Crossing. Cited by Elliott as a pioneering and inspirational leader in the fight against alcohol abuse and FASD, she is currently the Aboriginal and Torres Strait Islander Social Justice Commissioner.





# CLASSNOTES



**COKORDA PRAMARTHA**  
(PhD (Research) '18)

Using digital media as a tool for preserving culturally significant artefacts and practices is a focus for Pramatha in his role as an Assistant Professor in the Department of Computer Science at Universitas Udayana, Bali. Working in digital heritage (which develops strategies for preserving artefacts and practices produced in digital formats), and digital humanities (which uses digital collaboration to enhance study of the humanities), he has a particular interest in the Balinese culture. As the theme leader for digital humanities at the Centre for Interdisciplinary Research on the Humanities and Social Science (CIRHSS), his team collaborates with the Australian National University. Pramatha is also a Secretary of the International Office at Universitas Udayana where he assists and organises international promotion and collaboration.



**DEE TAYLOR-GRAHAM**  
(BVArts '09)

Taylor-Graham is a maker, writer and educator with a passion for the crafts. Starting as a primary school art teacher, she graduated from UNSW with a Master's in Art and Design Education and an unexpected love of ceramics. This love took her to Adelaide's creative arts hub, the Jam Factory, then back to Sydney where she picked up first-class honours and the University Medal at Sydney College of the Arts (SCA). After spending a year at Sturt Pottery, while teaching in the SCA Object studios, Taylor-Graham moved to Tasmania in 2013. After three years as Artistic Director for the Australian Ceramics Triennale, she now devotes her energy to Waldie's School for the Ceramic Arts where art, food and ongoing dialogue foster a creative community of women.



**FEI YAO**  
(BCom(2011) BE(Mech) '11)

As an edtech (educational technology) startup entrepreneur based in Singapore, Yao is on a mission to help busy professionals prepare for a rapidly changing world by integrating future-focused learning into modern lifestyles. She is the founder and COO of NewCampus, a modern lifelong learning school of business, technology and culture, which hosts daily classes in 'learning gyms' in Singapore and around Asia. This gives people continuous access to the skills, ideas and connections that they need to grow. Prior to her startup journey, she worked with Engineers without Borders on water purification innovation in Cambodia and was a management consultant at Accenture in Australia. She was recently named as one of the Forbes 30 Under 30 entrepreneurs in education.



**KATHRYN VIEGAS**  
(LLM '06)

Moving to Australia in 1994, Viegas qualified as an immigration lawyer in 2003 and is now an Accredited Specialist in Immigration Law, one of only 15 women to hold this accreditation. When she's not advocating for clients as the co-director of a female-led law firm, Nomos Legal, Viegas sits on the boards of three charities. She is the President of the Immigration Advice & Rights Centre, which helps vulnerable migrants and asylum seekers; Secretary of Diverse Women in Law, which empowers women from under-represented backgrounds to enter the legal profession; and Co-Founder of the TLR Foundation, which promotes bone marrow donation in Australia, and recently established the Trace Richey Nursing Scholarship awarded through the University of Sydney.

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**NICK OLLE**  
(BA '96)

Based in Malaysia, Olle produces documentaries for Al Jazeera's flagship Asian current affairs program, *101 East*. As Senior Supervising Producer, he's involved in the filmmaking from conception and direction to post production. After graduating, he studied law at the University of Technology Sydney, earning an LLB (Hons) in 2000, having already started work in journalism as a reporter for local newspapers. From 2005, he spent eight years in South America, co-founding a production company there and working as a multimedia correspondent for media networks including the ABC, NPR and The Global Mail. At Al Jazeera, he works on "bold, untold" stories from across Asia and the Pacific, covering everything from human interest features to major human rights violations and corruption scandals.



**DR PIPINA ELLES**  
(MA '98)

Born in Greece, Elles arrived in Australia in 1968, and has been an artist and a writer since 1970. Her works have been inspired by the Greek diaspora and shaped by her Australian home and experiences. Creative experiments have included painting, novels, theatre, poetry and extensive study in Greek theatre and literature; her Sydney thesis, written in Greek, was titled *The Greek Theatre produced under the auspices of the Orthodox Greek Community in Sydney plus surroundings*. She earned her doctorate at Flinders University with her thesis *The Presence of Women in Kazantzakis' Plays*. All of her written work is in Greek, except two books of poetry, a play and a children's story, written in English.



**SHOAIR MAVLIAN**  
(BVArts '06)

Mavlian has a particular interest in photography relating to conflict and memory. Currently director at *Photoworks*, a platform for contemporary photography, she oversees its program of commissions, exhibitions, publishing, learning and large-scale public events. Previously, she was Assistant Curator, Photography and International Art at Tate Modern, London, curating major exhibitions including *Shape of Light: 100 Years of Photography and Abstract Art* (2018), *The Radical Eye: Modernist Photography from the Sir Elton John Collection* (2016) and *Conflict, Time, Photography* (2014). She also researched acquisitions and curated displays from Tate Modern's permanent collection. As well, she works on independent curatorial projects, writes for magazines and was named one of *Apollo Magazine's* 40 under 40 Europe – Thinkers.



**TIMOTHY J SHARP**  
(PhD (Medicine) '98)

Starting his career as a clinical academic at the University of Sydney's Pain Management and Research Centre, Royal North Shore Hospital, Sharp went on to build a successful private practice, based on a total of three degrees in psychology. Making a philosophical shift in 2002, he established the Happiness Institute and was largely responsible for launching the Positive Psychology movement in Australia. He has championed happiness at work and become an outspoken advocate for the sharing of lived experiences with a view to smashing the stigma associated with mental illness. Along with a number of academic publications, he has written eight books, one audiobook, been involved in two national TV shows and a podcast series on masculinity.



# JUST THE FACTS

## ON UNDERSTANDING HOW TO HARNESS DETONATIONS

Engineers have been trying to harness the power of detonations for decades. The rotating detonation engine (RDE) is a relatively new and promising concept with continuous detonations revolving around a thin, ring-shaped combustion channel without moving parts. Detonation involves inducing a supersonic flame-front driving a preceding shockwave. The flame and shock happening together induces a step change in pressure and temperature and intense heat release. With a team of researchers at the University, I am performing computational simulations in collaboration with other universities, industry and government to build and test a working RDE that may one day take an Australian mission into space.



### Associate Professor Matthew Cleary

*Fossil fuels supply most of our energy but also produce harmful by-products and effects.*

*As a mechanical engineer and Deputy Head of School (Research) at the School of Aerospace, Mechanical and Mechatronic Engineering, Cleary's work seeks to minimise energy downsides.*

Dealing with vast amounts of information is just another day at the office for University researchers and academics. Here, two researchers explain an idea that is at the centre of their current work.

## ON UNDERSTANDING THE BODY'S MANY CLOCKS

Timing is everything. This saying takes on a new meaning when you think about time in biology – numerous processes happen simultaneously in the body, all perfectly aligned by our internal circadian (24-hour) clocks. If these clocks get out of step, this precisely tuned machinery breaks down and can lead to disease. I am especially interested in chronophysics: the physics underpinning circadian rhythms, for example, how the circadian oscillators interact, how they control biological processes, and how they can be controlled. There are several intriguing questions for me. How can we manipulate the clocks to prevent disease? And, can we minimise risks by predicting who might be in danger of an accident, for example, while driving?



### Dr Sveta Postnova

*With a PhD in computational neuroscience and a degree in physics, Postnova leads the chronophysics research group and is a Senior Lecturer in Neurophysics and Brain Dynamics. She is a Theme Leader at the Cooperative Research Centre for Alertness, Safety and Productivity.*

## YOU AND SAM

Where in the world do you read your SAM? Send us a photo and we'll put it in a future SAM edition.

[sam@sydney.edu.au](mailto:sam@sydney.edu.au)



**Anne Smith (BA '94)**

After learning about the Trobriand Islands during her anthropology studies, Anne recently had the opportunity to visit.



**Peter Ferguson (BE(Aeronautical) '79)**

It was a Sydney flight from Santiago. Pilot Peter Ferguson was having his SAM photo taken when flight attendant, Louise Kennedy, visited the flight deck. Turns out, they'd been at the University at the same time and had mutual friends. Arriving in Sydney, they had Christmas dinner together.



**Louise Kennedy (BAppSc(Physiotherapy) '82 MSportsPhysio '02 MPHith '10)**





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