



HISTORY'S FORGOTTEN WOMEN



PLANET HUNTING



WATER-WISE LUCERNE



AN EDUCATION IN JAMMING



THE WORD ON DIMINUTIVES

Research to Reality

2011 Edition 10



Sitting in my room as a teenager, practising chords on my guitar, I didn't realise that I was possibly nurturing my study skills. But that's one of the delights of this issue of *Research to Reality*. Jane Baker's investigation into the educational value of garage bands is a reminder of the possibilities that emerge when you think outside of the square.

The same can be said about many of the projects showcased in this issue: Tim Law's innovative research on air conditioning; Elissa Cameron's novel approach to the study of feral horses; and, the breakthrough application of laser technology to ore discovery.

Research today has become increasingly global and, with that in mind, The University of Tasmania is delighted that the multi-million dollar Bisdee Tier Optical Astronomy Observatory will begin operation early next year. The unique location of this telescope, in the Southern Midlands of Tasmania, will allow astronomers worldwide to access regions of the sky that are difficult or impossible to see from more northerly latitudes. It's yet another example of UTAS's ultimate vision, which includes utilising that which makes us distinctive, and harnessing what it is that sets us apart.

Professor Paddy Nixon
Deputy Vice-Chancellor (Research)

A heartfelt tribute to history's forgotten women

When artist Christina Henri was attending school, she knew only about the male convicts who were sent to Tasmania.

It wasn't until she was a UTAS fine arts undergraduate, and she visited the Cascade Female Factory as part of a Historical Landscape module, that Ms Henri was moved by the stories of the thousands of women who were transported to Van Diemen's Land.

Ms Henri's fine arts PhD project, *Engaging the convict legacy: art's role as a means of understanding*, aims to remember these forgotten women and to engage the community with their stories.

"I'm using conceptual and installation art as an important tool to tell colonial history – and specifically the history of female convicts," she said.

"We've just had 11 convict sites inscribed as World Heritage in Australia and the largest number of those have been in Tasmania.

"A big part of my PhD is the memorial to the convict women, *Roses from the Heart*, that looks at the entire number of convict women who came out to Australia. I'm creating a collection of cloth bonnets that symbolises each of the convict women."

The memorial requires 25,566 bonnets to represent the lives of all the women transported to the Australian colonies from 1788-1853.

And, after inviting other people to take part in sewing the pieces, Ms Henri has received beautifully crafted bonnets from all over the world. To date, she has collected 20,066 bonnets.

"A Tasmanian woman has made 1,500 wonderful bonnets," she said.

"I've had people come from England, Ireland, France, Canada and New Zealand to personally hand me their bonnets. They want to see the site where their woman spent time – at the female factory, or perhaps where she was assigned to work. Participating in the Memorial is the impetus to follow a female 'convict trail' around the State.

"And even if the bonnet-makers don't come out physically, they come mentally and emotionally because they get very involved. They become engaged with the female convict that their bonnet commemorates."

If the bonnet-maker is a descendant of the female convict, the connection is particularly significant.

"But if people have no female convict ancestry, I still try and match them in some way, by name, place or their offence, so there is a real engagement as the participant sews the bonnet and makes that tribute to the woman," Ms Henri said.

"This island is rich with living tourism. I want people to engage with those spaces and experience those stories."



Bonnet-makers have travelled from England, Ireland, France, Canada and New Zealand to personally deliver their beautifully crafted pieces.

Aussies think it's beaut when Davo and Shazza have a barbie in the arvo



Australians are more likely to invite you to a 'barbie this arvo' than a 'barbeque this afternoon'. In fact, 'Aussies' are more likely than speakers of any other variety of English to use abbreviated (or sometimes lengthened) forms of words.

Dr Evan Kidd, an Australian researcher now at the University of Manchester, UK, and Dr Nenagh Kemp, from the UTAS School of Psychology, are investigating how we form these diminutives – and why Australians do it so much.

Dr Kemp said this shortening of words has been described by linguists for decades but, until now, has not been investigated experimentally.

In 2010 Dr Kidd, Dr Kemp and UTAS student Sara Quinn asked more than 100 Australians, aged 17-84, to write down as many of these diminutives as they could in 10 minutes.

"Respondents came up with an average of 23 diminutives, but their examples differed according to their age,"

Dr Kemp said.

"Older people thought of more 'o' words, such as *ambo* and *muso*, as well as 'y' words, like *footy* and *telly*.

Younger people were more likely to drop word endings – such as *mag*, *ump* and *uni* – although they sometimes added an 's', such as *mobes* (for mobile phone)."

Current research with UTAS honours student Vanessa Burton is looking at how people form diminutives with words they have not previously seen.

PARTICIPANTS LAUGH AND SMILE SIGNIFICANTLY MORE DURING AN INTERACTION WHEN THE OTHER PERSON USES DIMINUTIVES.

"We've invented a list of placenames, personal names and nouns, and are asking respondents to decide how they would make them sound more Australian," Dr Kemp explained.

"With more than 100 respondents so far, we're finding that the two most common changes are to add a 'y' ending or to remove the last syllable of a word. We'll also be looking at whether older people have different ideas about diminutives than younger people, or men than women."

Dr Kemp said the other pressing question is why exactly Australians are so fond of diminutives. It saves a small amount of time to say *ump* rather than *umpire*, but the use of diminutives might have a social role as well.

"In ongoing research, we are examining whether people respond differently to a conversational

partner using diminutives in their speech in a direction-giving task ('take a *righty* out of the *uni*') versus avoiding them ('turn *right* out of the *university*')," she said.

"We're also looking at whether people's reactions differ depending on whether that conversational partner is Australian, or from another country.

"We're finding that our participants use significantly more diminutives themselves when their conversational partner uses them. More importantly, diminutives seem to play a social role: we're finding that our participants laugh and smile significantly more during the interaction when the other person uses diminutives, compared with when they don't.

"This research can provide information about how we, as Australians, use language and how we judge others' use of it, with important social implications."

Dr Nenagh Kemp, from the UTAS School of Psychology, is a member of a team investigating why Australians embrace abbreviated forms of words.

Planet hunters and the quest for frozen 'super Earths'

THE HOLY GRAIL OF THE PLANET HUNT IS TO FIND EARTH-LIKE PLANETS AT LIVABLE DISTANCES FROM SUN-LIKE STARS.

More than 700 planets have been discovered in our galaxy, to date, by astronomers around the world – but not one of these planets looks like the Earth, and none is in solar systems that resemble ours. It's a realisation that cuts to the heart of the ageless questions about where the Earth came from and whether habitable planets are common or rare, explained Dr Andrew Cole, a lecturer from the UTAS School of Mathematics and Physics.

"There is no settled theory to explain how the Earth and other planets came to be the way they are," Dr Cole said.

"All the 20th century theories had to go back to the drawing board once we starting finding other planetary systems because we haven't found anything that looks like ours. Most of the planets we've discovered are much larger than the Earth – even the smallest have been three to five times the size of the Earth, and often their orbits are so close to their host stars that rocks would be molten and water would just boil away."



Far left: An artist's impression of a super-Earth planet far enough from its star for liquid water to exist.

Left: The unique location of the Bisdee Tier telescope will allow astronomers to access regions of the sky, such as the centre of the Milky Way, that are difficult or impossible to see from more northerly latitudes.

It's not possible to go back in time to watch how the Earth came into being, so astronomers hope to piece together the puzzle by finding similar planets, and then comparing them with the Earth. In particular, the planet hunters are looking for 'cold Earths' or 'frozen super Earths'. These planets are similar to the Earth in that they're mostly rock, but they're described as 'cold' because they're far enough away from their Sun to contain water. The holy grail of the planet hunt is to find Earth-like planets at livable distances from Sun-like stars.

Tasmania will step up its role in the ongoing hunt for planets when the Bisdee Tier Optical Astronomy Observatory begins operating in early 2012. This 1.3-metre, modern telescope is located in the Southern Midlands region of Tasmania, replacing the smaller facility that has operated near the city lights of Hobart for the past 35 years.


The new telescope will allow astronomers to study the light that emanated from distant objects millions of years ago, although the main project for now is studying the stars near the centre of the Milky Way (as close as 25,000 light-years from Earth). The unique location of the new telescope will allow astronomers to access regions of the sky (such as the centre of the Milky Way and the Magellanic Clouds) that are difficult or impossible to see from more northerly latitudes, making Tasmania a leading partner in worldwide telescope networks.

"There is a philosophical aspect to this research in questioning where we've come from," Dr Cole said. "There's also the hard science of learning how planets are formed.

"It's just very exciting to think about the other planets and solar systems out there. It almost feels like a responsibility to learn these things because if we don't ask these questions, then who will?"

Close to half of the \$5.46 million needed to build the Bisdee Tier Optical Astronomy Observatory was raised through generous contributions from friends of UTAS and supporters of scientific research.

Questions about whether habitable planets are common or rare ... Dr Andrew Cole from the School of Mathematics and Physics.



The birds and the bees ... and their impact on feral horses

Professor Elissa Cameron's research interests read like the line-up in a contemporary menagerie: there is everyone's favourite small mammal, the meerkat, and favourite tall mammal, the giraffe. There's the little-known aardwolf – a hyena which dines almost exclusively on termites – and the much more common elk and mule deer, warthog and elephant seal.

The wild horse and the bobby calf figure largely in this onetime farm girl's work, and the quokka – which forms her Australian contingent – will soon be joined by the sugar glider and the brush-tailed possum.

Prof Cameron is an expert on the ecology, behaviour and conservation of mammals, and in particular, the different strategies adopted by male and female mammals. Manipulation of sex ratios is a significant strand of her research.

NZ-born and educated, Prof Cameron joined the UTAS School of Zoology last year. Previously she had spent two years in the Kalahari Desert studying meerkats – specifically the Whiskers and Lazuli groups who would later feature in the hit TV series *Meerkat Manor*. "I knew them before they were famous," she laughs.

After the fast-moving meerkats came a change of pace in the form of slow-mo giraffes. In a paper entitled 'Social Influences on Vigilance Behaviour in Giraffes (*Animal Behaviour*)', Prof Cameron and her co-author Johan du Toit posited that foraging giraffes were more concerned about their own species than any external threat. "Big aggressive males club each other with their horned heads – it looks balletic but it's really brutal."

Next stop was Reno, perhaps best known for its casinos, but that obviously wasn't the attraction for Prof Cameron.

Professor Elissa Cameron is an expert on the ecology, behaviour and conservation of mammals, and in particular, the different strategies adopted by male and female mammals.

“My work in Nevada, which is extensive and ongoing, concerns that age-old problem not only in the US but also Australia and New Zealand – feral horses,” she said.

“We have been doing contraceptive trials on the horses, particularly those where contraceptives are not effective, and also looking at the side effects.”

By side effect, Prof Cameron means the societal impact. Two contraceptives are used, one of which stops the reproductive cycle altogether.

“If a female doesn’t become pregnant, does that affect the social structure of the herd? If a female stops cycling and effectively becomes asexual, how does the stallion feel about that? Does the female drop in rank in the band?”

“If the female continues to cycle but doesn’t ever become pregnant, what effect on the band will that have? If a female is cycling, a stallion will increase his investment in her and the bachelor males are attracted. It also increases

THE BIGGEST PREDICTOR OF REPRODUCTIVE SUCCESS – EVEN ABOVE AGE, EXPERIENCE AND HARASSMENT BY MALES – IS THE CLOSENESS OF THE ‘FRIENDSHIPS’ WITH OTHER FEMALES IN THE HERD.

destabilising effects of contraceptives.”

Drawing upon her undergrad studies in psychology (alongside zoology) Prof Cameron is also studying social bonding among female members of a herd.

“We’ve found that the biggest predictor of reproductive success – even above age, experience and harassment by males – is the closeness of the ‘friendships’ with other females,” Prof Cameron said.

“Social bonding is something that we have been scared to look at in the past, because of the fear that it would be seen as anthropomorphism.

“But sometimes we forget that we’re mammals too.”

her grumpiness, so you get these interactions between mares.

“We know that sometimes a female will leave the group if she doesn’t become pregnant, because there might be some genetic incompatibility. In this case a non-cycling female might leave the band. So we are looking at the

Feral horses appear quite majestic, but they have long been a problem in Australia, as well as in the US and New Zealand.

A breath of fresh air in personal air conditioners

The idea of sitting in your car, opening your laptop and starting a day's work might not seem very appealing – although when you think about it, there would be a few positives.

Your car would have a comfy seat, for instance, and you'd also have access to a personal stereo, which you could play at any volume without annoying your colleagues. You'd even have your own personal air conditioner.

It's this last point that got School of Architecture and Design PhD student Tim Law thinking. Air conditioning is notoriously expensive in large office buildings. Surely there must be a better, cheaper way to do it! Mr Law's answer is personal air conditioners, one for each staff member.

Since the 1970s, researchers, engineers and architects have been finding new ways to make buildings more energy efficient, with better climate control. But Mr Law found that while the research was solid, developers weren't always interested.

"The economics of most office buildings are predicated on lease premiums, so that means maximising the lease premiums for the developer," he said.

"You always put the offices around the perimeter, because when there is a view you can charge more for that. You have big facades and lots of glass. This always means a great deal of air conditioning.

"So regardless of what the scientists are saying, the market is still demanding something else. We have to give the market what it wants, or no-one is going to buy the solution."

The running of commercial buildings accounts for 10 per cent of Australia's greenhouse gas emissions. Nearly half of that figure is used on heating, ventilation and air conditioning.

"From our point of view, we wanted an air conditioner that was more efficient," Mr Law said. "Developers wanted an air conditioner that took up less space. We could help them to achieve that with a personal air conditioner, which is decentralised over all the tables. And since the central plant is much smaller, it gives them more leasable office space.

"From the building manager's point of view, you always have people complaining that the air conditioning is either too hot or too cold, or not working properly. By giving employees individual air conditioners, everyone can adjust it the way they like."

Mr Law designed and built four prototypes of the Ductless Task Air Conditioner, a wooden box about the size of a desktop computer tower.

The inspiration for the prototypes comes from the car, where the air conditioner blows straight at you. The moment you turn the ducts away, it loses its efficiency drastically because it doesn't really cool the space.

"Inside the box we have a fan and a phase changing material – which, in this case, is wax," Mr Law said.

"As the heat passes across the wax, the wax melts. When you leave the office, you switch it off and the wax releases its heat and solidifies again, ready for the next user."

Mr Law is hopeful of commercialising the Ductless Task Air Conditioner in the near future.



PhD student Tim Law has designed and built four prototypes of personal air conditioners.

Insert: Mr Law demonstrates his personal air conditioners to colleague Matt Taylor.

Lucerne: winter dormancy could guide the 'drought-proofing' of farms

Surprise results from a research project into the fodder crop lucerne have provided some solace to Australian farmers facing the challenge of meeting the feed needs of livestock.

Growing grass and fodder crops is getting trickier, with predictions of more variability in annual rainfall, and less certainty of irrigation water supply. Drought tolerance and efficient water use are becoming vital characteristics for farmers choosing grass and fodder species to grow for cattle and sheep.

Lucerne has been widely used for decades as a nutritious forage crop in the cereal-producing farming areas of eastern Australia. It has been a key crop in diversifying farm enterprises, allowing farmers to fatten prime lambs and cattle when cereal prices have plunged.

Other benefits of lucerne include a deep tap root for accessing ground water and, being a legume, it contributes a ready supply of nitrogen to the soil, boosting soil fertility for subsequent cereal crops.

Dr Keith Pembleton – from the Dairy Centre at the Tasmanian Institute of Agricultural Research (TIAR), on the UTAS Cradle Coast campus – recently completed his PhD project identifying genes that determine the drought tolerance of lucerne plants. The four-year study was a collaboration between TIAR and American scientists. Dr Pembleton undertook a year of research in the United States as a Fulbright Scholar.

“A surprise result of the research was the discovery that the genes that enable some lucernes to adapt to freezing temperatures can potentially help them endure dry spells,” Dr Pembleton said.

“Identifying this link between drought tolerance, winter dormancy and freezing tolerance will enable farmers to select for drought tolerance

from currently available lucerne cultivars, while providing breeders with novel sources of drought tolerance traits to improve the drought adaptation of lucerne into the future.”

Dr Pembleton said his research results are of particular interest to dairy farmers who are facing big challenges due to their heavy reliance on irrigation water to sustain forage production.

“Recently there has been increasing interest from dairy farmers in growing lucerne to ‘drought proof’ their properties,” Dr Pembleton said. “As the cost of irrigation water increases and availability decreases, there will be a growing demand from dairy farmers to find lucerne cultivars with superior drought tolerance, so they can grow the best quality fodder using the least water.

“Until recently, Australian lucerne breeding programs have focused on developing cultivars specifically suited to irrigated hay production enterprises and not dryland dairy farming systems. This means that the level of drought tolerance in currently available lucerne cultivars is unknown. However, our recent investigations have shown that it’s possible to look for genes associated with winter dormancy and freezing tolerance and expect improved drought tolerance from these cultivars.”

Dr Pembleton said his current project involves a closer investigation of how this association can be used to give farmers a nutritious fodder crop that will keep producing under drier growing conditions.

**THE GENES THAT
ENABLE SOME LUCERNES
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This research is supported by Dairy Australia and the 2011 Department of Agriculture, Fisheries and Forestry Science and Innovation Awards.

Dr Keith Pembleton recently completed his PhD project identifying genes that determine the drought tolerance of lucerne plants.



Jamming in garage bands: a disciplined approach to learning

DURING REHEARSALS, THE BANDS SET GOALS AND MADE PLANS. ONE GROUP EVEN USED A WHITEBOARD!

Playing in a garage band is more than just hanging out and jamming with friends, research within the School of Education has found. It is, in fact, a disciplined approach to learning.

PhD candidate Jane Baker melded her two areas of expertise, sociology and education, to investigate the way teenagers in garage bands learn – outside formal education.

“There were some surprising results,” she said. “The most surprising was in the area of learning. I found the young people had an ordered approach to learning and were very disciplined, which is different to the popular view of garage bands.”

Ms Baker studied five Tasmanian bands. She interviewed the participants in their groups, as well as individual band members, their teachers and their parents. She also attended performances and rehearsals for heavy metal, pop-rock and folk-rock bands between 2007 and 2009.

This research indicated that these young people had a disciplined approach to learning within the band. During rehearsals, they set goals and made plans. One group even used a whiteboard!

“I didn’t expect to see the level of dedication I saw,” Ms Baker said.

Many of the students in the study did not perform well in formal education, but this research suggested they have the ability to do so in an informal or alternative setting.

“If we can tap into the energy in these self-motivated learning opportunities, it would be great for the educational system,” Ms Baker said, “even if it is just to the point of validating what happens in these learning situations, not just seeing it as mucking about.”

Ms Baker said she hoped this research would be considered by the educational sector and that different approaches to teaching may be adopted.

“From a sociological point of view, I’m interested in the way we could change some structural norms in education to validate these different forms of learning.”

A narrative account of one of the bands in the study will be released in the near future as a chapter in the book *Narrative Soundings: An Anthology of Narrative Inquiry in Music Education* (edited by Margaret Barrett and Sandra Stauffer, published by Springer).

PhD candidate Jane Baker melded her two areas of expertise, sociology and education, to investigate the way teenagers in garage bands learn – outside formal education.



How old is the rock you're standing on? Does it contain valuable minerals? Could it be worth mining in the future?

For geologists, these are important questions to answer, explained Dr Sebastien Meffre, a research fellow at the Centre for Ore Deposits and Exploration Studies (CODES). By knowing a rock's age, geologists can determine whether it is likely to contain economically valuable mineralisation. For instance, many of the 350-million-year-old granites from Tasmania are associated with tin deposits.

"Mining companies are often looking for a particular age rock, which could be more likely to host economic mineralisation," Dr Meffre said.

To determine the age of a rock, researchers at CODES have perfected a technique using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS).

Traditionally, the dating process meant that bulk samples of rocks had to be digested in a mixture of acid and their composition analysed. But the LA-ICP-MS technique uses a laser that drills a small hole in the crystals and feeds the material obtained from the hole into a mass spectrometer.

"Dating using LA-ICP-MS targets specific minerals that contain a small amount of uranium when they first crystallise," Dr Meffre said.

"Over time, the uranium turns to lead through a process of radioactive decay. Researchers can determine the age of the crystals by measuring the amounts of uranium and lead in the samples."

Two of the better-known crystals used for this purpose are zircons and apatite. These occur in most rock types, including the rocks that you may be standing on while reading this article! Fifteen years ago, uranium-lead dating costed up to \$4,000 per date. With the advent of LA-ICP-MS, costs are down to a fraction of that figure.

"We're also increasing the number of minerals we're able to date," Dr Meffre said.

The techniques and the instrumentation are very versatile. In addition to the dating, they can also be used to analyse the chemical composition of various minerals or any other material including bone, paper, shells, ceramics or even biological material.

CODES currently has three LA-ICP-MS laboratories, each focused on a different type of mineral and method of analysis (including imaging of trace elements, and chemical analysis).

Laser sheds light on the ages of rock

The leader of CODES' Technology Program, Professor Leonid Danyushevsky, said the technology is reasonably standard.

"But the work at CODES has increased the span of LA-ICP-MS applications," Prof Danyushevsky said.

"It's not so much a breakthrough in technology – more a breakthrough in its application."

Most research at the centre looks at the concentrations and distribution of trace elements for a broad range of applications, from understanding the origins of ore deposits through to the origin of different types of magmas generated in the Earth's mantle.

At the moment, the LA-ICP-MS equipment is primarily used for geological work, but there is potential for its use in other areas. For example, it is already being used in some life sciences applications, including analysing the chemistry of fish otoliths, statoliths and stylets.

Laser mass spectrometry research at the University of Tasmania has been occurring in the CODES & the School of Earth Sciences since 1998 from a variety of funding sources including ARC (LIEF, Special Research Centre, Centre of Excellence), the University and various mining industry sources.

The leader of CODES' Technology Program, Professor Leonid Danyushevsky (left), with research fellow Dr Sebastien Meffre.

Inset: Dr Sebastien Meffre has perfected a technique in dating rock samples, but the equipment being used has potential for wider applications.



OUR GRADUATES HAVE WHAT IT TAKES.

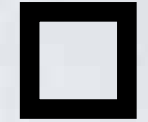
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