



pheno

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Government House Celebration of New Zealand Identity

In March, the US National Geographic Genographic team, led by Project Director Dr Spencer Wells, visited New Zealand and sampled the DNA of over 100 New Zealanders - mostly Wellingtonians. AWC Principal Investigator, Professor Lisa Matisoo-Smith, is the Project's Oceanic investigator, and she is taking an extended sample of 2000 New Zealanders, thanks to a James Cook Fellowship and support from the Allan Wilson Centre and the University of Otago.



*Governor-General, Lt Gen The
Rt Hon Sir Jerry Mateparae*

The results of this special National Geographic one-off sample will be disclosed and interpreted, and our mitochondrial lineage affiliations celebrated, at Government House on 27 August. A sample from Governor-General, Lt Gen The Rt Hon Sir Jerry Mateparae, is currently being processed at the laboratory in Washington, and will hopefully be ready in time for the event he is hosting.

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Other VIP 'samples' included Dame Anne Salmond, 2013 Kiwibank New Zealander of the Year; Sir Anand Satyanand, The Hon. Tariana Turia, Professor Sir Peter Gluckman and The Hon. Winnie Laban.

A map showing the human diaspora out of Africa, as chronicled by the mitochondrial DNA analysis of maternal inheritance, is enclosed with this issue of Pheno. You can find out more about Lisa's research, and the global Genographic Project at www.africatoaoteaoroa.ac.nz and www.genographic.com respectively.



What story does your DNA tell?

Lisa will be taking DNA samples next in Nelson and Queenstown (50 from each location), where she is giving presentations on her work on 12 and 13 August. To register to receive early information about Allan Wilson Centre public events, email awc-lectures@massey.ac.nz with the name of your city location in the subject line.



“It doesn’t get better than that!”



Professor Phil Bishop (UoO), Professor Charles Daugherty AWC Emeritus Investigator, Dame Jane Goodall, Celia Wade-Brown, Mayor of Wellington and Ms Karen Fifield, Chief Executive, Wellington Zoo

The Allan Wilson Centre sponsored Dr Goodall’s NZ tour together with the University of Otago, and Wellington and Auckland Zoos. The tour raised \$100,000 through ticket sales, to support Jane’s work.

The last of the 2200 people to leave the Michael Fowler Centre after Dame Jane Goodall’s talk in June was a young man who had read all about Jane’s African adventures. “It doesn’t get better than that,” he said, “to see your childhood hero” - a sentiment repeated by more than one person attending Jane’s talks.

The scores of people in the book signing queue – an hour and a half’s worth – all had their own Jane story. And Jane’s own story captivated. Fifty five years ago, when the majority of young women had choices of marriage, teaching, nursing, the typing pool or shopwork, Jane saved up her waitressing money, went to Africa and asked Louis Leakey, the world’s most famous palaeontologist, for a job - and got it! Not because she had high family connections, or a PhD in Zoology, or looked robust enough to survive alone in the forest (far from it!), but because she was clearly the best person for the job. Her knowledge of animals, quiet determination, and cool response to being followed by a lion while on a field trip with Louis and his family, convinced him of that. At just 26, and with her enlightened mother’s blessing, she was assigned to study chimpanzee behaviour in the Gombe Stream Game Reserve, in present-day Tanzania.

The last person in the book signing queue was Dr Melanie Vivian, who had completed her PhD on captive primate welfare and behaviour at Wellington Zoo. She clutched her 2kg thesis to her chest as she patiently waited – patience being an important virtue for humans studying fellow primates. During her talk Jane described the great moment of her life when David Greybeard finally trusted her enough to accept food from her, and made eye contact – she said she can still feel the touch of his leathery fingertips on the palm of her hand. The profound impact of that connection was perhaps the real beginning to a lifetime of scientific research and dedication to her subjects that now takes her all over the world to raise money to help save chimpanzees’ habitat, and provide sanctuaries for orphaned and endangered animals. Jane understands how to appeal to, and make an intimate connection with, her fellow humans.

She finally emerged after the book signing marathon. Sensing true devotion, organisers invited the young fan to stand with them in a guard of honour to wave goodbye to Jane outside the venue. Without a word being exchanged, Jane perceived the situation and rewarded his wait with a special smile and wave, which he will surely never forget. The 6000 people who attended the sell-out talks in Dunedin, Wellington and Auckland will not forget Jane’s presence either. One described it as the “perfect experience”.

“Jane found the response to her tour of New Zealand to be so successful that she considered it was the right time for the establishment of the Jane Goodall Institute in New Zealand. The chapter of the organisation is being co-founded by myself (CEO) and Professor Phil Bishop (Board Chair). The fact that this has been the result of Jane’s tour is the most incredible outcome and we’ve had global support so it is fantastic.”

- Dr Melanie Vivian



Never a minute wasted: Liam meets Dr Goodall



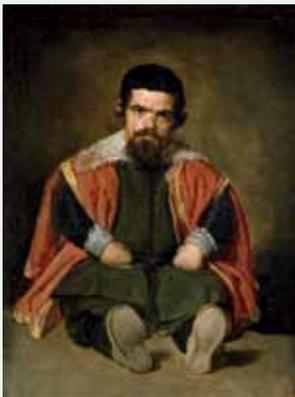
Liam Adrian, Dame Jane Goodall and Mr. H

When Liam Adrian met Jane's colleague, primatologist Craig Stanford, who toured New Zealand a year ago, he described it as the best night of his life. The Allan Wilson Centre remembered this and invited Liam and his family to Wellington to meet Dr Goodall, and attend her talk. He told her about his research into the plight of orangutans. Liam reflected on this special meeting in his thank you letter:

... "I thought she was a pretty amazing lady to be able to go all the way to Africa at the age of 23, and end up studying chimpanzee in the wild, and now at the age of 80 still travelling 300 days a year giving presentations all over the world. I don't think she has ever wasted a minute of her life.

"Jane talked about the damage that has been made to the planet and that it is my generation that will need to fix the problem. As a 10-year-old I was thinking how could I possibly help fix a planet that's too big, and very overwhelming. Then I realized that everyone has a chance to make a change to help save the planet and we all need to do our bit and doesn't matter what size it all helps. The animation that I made for a competition has taken me on a journey of discovery and learning, and awareness of what is going on in the world."

The Renaissance Art of Disease and Genetics



Diego Velázquez – Portrait of Bufón Don Sebastián de Morra, 1643-44, Museo del Prado



Lavinia Fontana – Portrait of Antonietta Gonzalez, 1595

It takes a rare and true "Renaissance man" to bring together knowledge of medicine, epidemiology, psychology, social history, art, and music in one lecture. Professor Lord Winston came all the way to Wellington to deliver a one-off and brand new presentation, following his keynote address on childhood development to the NZ Childcare Association Conference in Auckland.



Professor Lord Winston signing one of his books for an excited fan

The lecture was highly visual – a collection of Renaissance paintings showing subjects with various diseases and genetic defects, and his interpretation of the painters' attitudes to them. There was also some music (he is currently Chair of the Royal College of Music Council, and wants to understand the powerful effect of music on humans) and other psychological curiosities thrown in.

Following the presentation, large numbers of the audience took the opportunity to meet Lord Winston as he signed copies of his many books. Despite being already sleep deprived and facing a 3.30am wake up call the next morning, he showed generosity and kindness rather than impatience with those who wanted to have their photo taken with him – almost everyone! Lord Winston had to be back in the House of Lords by the end of the week for the debate on Lord Falconer's Bill on 'assisted dying'. Anyone who thinks the arguments in favour of euthanasia are straightforward may have changed their mind had they heard Lord Winston explain his opposition.

The talk at Wellington's Embassy Theatre was organised by the Royal Society of New Zealand and the Allan Wilson Centre, and co-sponsored by Gravida and the University of Otago Medical School.

Is New Zealand the world's eradication hotspot?

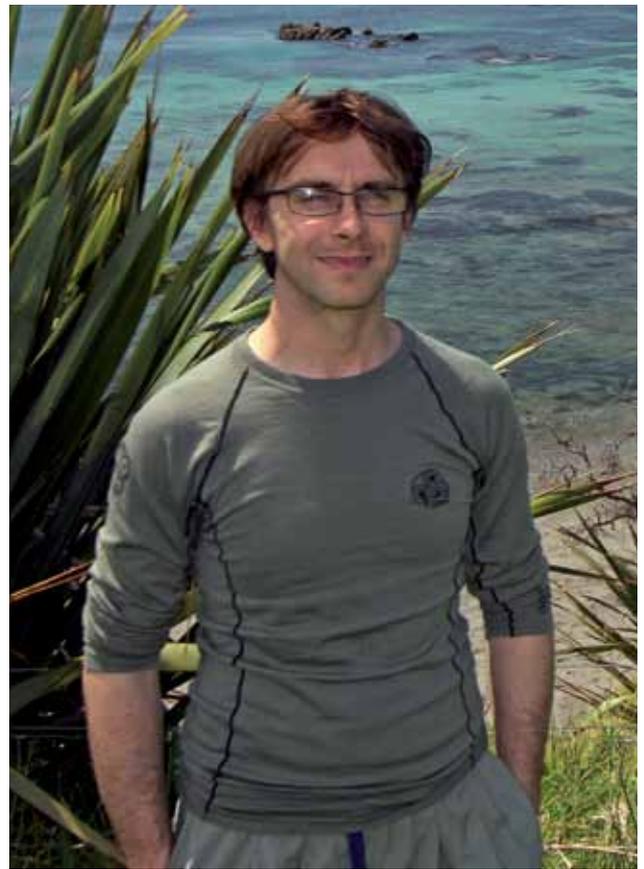
By James Russell

New Zealand has a proud and enviable track record in eradication of invasive species. In 2014 we celebrate 50 years of rodent eradications (Norway rats from Maria Island in the Hauraki Gulf), and in 2015 we celebrate 100 years of ungulate eradications (goats from South East Island in the Chathams).

But just how far have we come with eradications, how much further is there to go and how do we stack up against our international counterparts? In 1964, 0.5% of New Zealand's offshore island area (i.e. excluding the principal North and South Islands) was free of introduced mammalian predators. This is typical for most archipelagos around the world (e.g. British Overseas Island Territories, Western Indian Ocean Islands). In the fifty years following we have increased that mammal-free island area to 10%, by eradication or natural die-off of mammals from over 100 islands (about a third of New Zealand's offshore islands). Although 10% of the total island area is not large, it may be a useful international target for pest-free offshore island area for other countries to aim for, such as with marine reserve targets.

The size of islands from which rodents have been eradicated increased by an order of magnitude every decade from 1964 (1 ha) through to 2004 (11,330 ha Campbell Island), but has plateaued since then. This is not due to a lack of islands to eradicate introduced mammals from, instead the 'wall' appears to be the challenge of pest management on inhabited islands. Attitudes to pests and their control is playing an ever more important role in conservation decision-making. Eradication of invasive predatory mammals from Aotea (Great Barrier Island) and Rakiura (Stewart Island), would increase offshore island predator-free area to over 50%, and follow our Moore's Law for island eradications. The remote and uninhabited Auckland Islands are also a clear target for invasive mammal eradication. When we compare our performance in island eradications, we have undertaken about 30% of all attempts worldwide, over twice as many as our neighbour Australia, and six times that of the United States, Mexico, or the Falkland Islands.

All these statistics exclude the principal North (Te Ika a Maui) and South (Te Wai Pounamu) islands of New Zealand. This is despite the fact that recent research suggests island conservation will need to focus on larger islands to mitigate the threat of climate change. On these principal islands some level of invasive mammal management occurs over 45% of



Expert on pest eradication, Dr James Russell

land area, comprising pest surveillance and occasional aerial control by 1080, for both agricultural and conservation goals. However, intensive management of invasive mammals to zero density, particularly through predator-proof fences, only currently occurs across 0.25% of the principal islands (56 eco-sanctuaries). The Predator-Free New Zealand concept aspires to remove eight species of invasive mammal (3 mustelids, 3 rats, 1 mouse and 1 possum) across the whole of New Zealand. This bold goal would require up-scaling island eradication technology from islands, to fenced sites, to peninsulas, and finally to non-fenced sites. As we move towards such a goal, the distinction between a one-off island eradication and management to zero-density becomes less and less clear.

Beyond mammals, exciting advances in eradication of other species are also emerging. As for mammals, these advances are based on a solid scientific foundation of understanding the population biology of the target species to optimise control timing and methods. Bird and plant eradications have been recorded, while ant eradication is on the horizon. However, much more work is required on control and eradication of the whole suite of highly invasive species in New Zealand.



Allan Wilson Centre postdoctoral fellowships awarded for 2014

Three postdoctoral fellowships, awarded this year by the Allan Wilson Centre (AWC), foster the early careers of candidates who have demonstrated excellence in their doctoral studies. Ben Phiri, Libby Liggins and Patricia Jaros are working on three very different research projects, reflecting the wide range of skills and expertise these scientists bring to the AWC.



Ben Phiri

Ben's postdoctoral project will address important questions about water quality in the Uawa River catchment area on the North Island's east coast. The AWC's Uawanui Sustainability Project is a community-led initiative that aims to achieve long-term economic, environmental and social benefits. AWC participants are working with Te Aitanga-a-Hauiti and the Uawa Tolaga Bay community to explore opportunities for an integrated approach to sustainable land management and restoration across the Uawa River catchment.

Ben will examine the levels of microbiological contamination in drinking water and water used for recreational purposes, and determine which parts of the catchment area present the greatest public health risks associated with microbiological contamination of water. Samples will be tested from several different sites, and at different times, to assess how pathogen levels fluctuate throughout the year. Ben will also test shellfish species collected as a food source, for the presence of human pathogens. Ben's work in recent years as an AWC PhD

candidate has provided him with the experience and skills required to tackle this new project. He has been investigating pathogen levels in drinking water from DOC campgrounds around the country, through a combination of fieldwork, biotechnological and computational approaches, under the supervision of AWC Principal Investigator Professor Nigel French. A central aim of Ben's one-year Uawanui project is to develop a sampling plan and establish baseline studies for ongoing analyses and management of water quality in collaboration with stakeholders in the local community.



Patricia Jaros

Patricia Jaros recently completed her PhD as a member of AWC PI Professor Nigel French's mEpiLab group at Massey University, and has now taken up a postdoctoral position within the group. Her PhD research focused on the molecular epidemiology of an important human pathogen known as STEC O157 (Shiga toxin-producing *Escherichia coli* serotype O157:H7). The AWC-funded postdoctoral project allows Patricia to continue her work on STEC O157, through genomic-level analyses of the pathogen.



The bacterium *Escherichia coli* is commonly found in the lower intestine of warm-blooded animals, and has become a model organism for scientific studies as it is simple and cheap to culture in laboratories. Although most strains of *E. coli* are harmless to humans, and may even provide benefits to their hosts as a part of the gut's normal microflora, infections by STEC (O157 and other non-O157 STEC serogroups) can result in serious health problems. New Zealand has one of the highest incidence rates of STEC cases in the world, and Patricia's research has revealed that environmental, rather than food borne, pathways are more important in the epidemiology of STEC infections in New Zealand. This is a surprising result, as cattle have previously been assumed to be the most significant hosts of STEC O157, and consumption of their meat the major source of human infections. Patricia's postdoctoral project aims to find out more about the STEC O157 strains present in New Zealand by genomic sequencing and analysis of more than 100 isolates originating from cattle and humans – addressing questions such as where in the world they are likely to have come to New Zealand from, and when; and whether cattle, or another host, provides the most important source of the bacteria responsible for human infections in New Zealand.

genetic markers to investigate the historic and contemporary movement of common reef fish and invertebrates around the coral reefs of Australia, the West Pacific and parts of the Coral Triangle. Libby will continue her work with marine species this year, in a project with AWC Investigators Professors Marti Anderson and Paul Rainey which aims to increase our knowledge of New Zealand's marine biodiversity – and develop valuable new methods for examining ecological data from an evolutionary perspective.

While studies of biodiversity in New Zealand, and worldwide, have tended to focus on terrestrial organisms, a large scale project recently undertaken by Marti, with colleagues from Te Papa, has greatly broadened our understanding of biodiversity within New Zealand's oceans. The types of fish making up the ecological community were determined at a series of different depths (ranging from 50m to 1200m) at seven different locations. A total of 192 different ray-finned fish species were identified, and the conclusions drawn from Marti's statistical analyses so far include the findings that there are clear differences in the composition of communities at different latitudes, and that the number of species present in communities tends to decrease with depth. Libby's project will involve the construction of a phylogeny, or an evolutionary tree, of the fish species, using DNA sequences available on public databases where possible and with new data generated from the tissue collections held at Te Papa as required. Libby and Marti then aim to develop and apply ways of linking the information contained within the phylogeny to the ecological community composition data, providing insights into the evolutionary and ecological processes that have led to the current diversity and distribution of marine fish species.



photo by Michele Weber

Libby Liggins

In August, Libby Liggins will be taking up an AWC postdoctoral fellowship at Massey University's Albany campus. This is a return to the AWC for Libby, who completed her Masters degree at Victoria University. Her recent doctoral research at the University of Queensland has used



Libby Liggins sampling crown of thorns starfish in the Kermadec Islands. Photo Credit: Andrew Berry

2014 Canterbury Research Medal for AWC mathematician



Allan Wilson Centre Deputy Director, Professor Mike Steel, who is using mathematics to help biologists discover more about the evolution of life, has been recognised for his work with the University of Canterbury's Research Medal. This Medal is awarded annually by the University Council to recognise research excellence, based on letters from international referees.



Allan Wilson Centre Deputy Director, Professor Mike Steel

Mike is best known for his leading work in phylogenetics, or the science of reconstructing evolutionary trees and networks from genetic data. He says his research methods are used every day to study how different strains of bacteria and viruses like influenza and hepatitis are related to each other.

"They're also used to help figure out where some newly discovered organism fits in the tree of life, or how much biodiversity is at risk from current high levels of extinction.

"Phylogenetic techniques are also starting to be applied in medical research to reconstruct the tree of cell divisions in a tumour, and in linguistics the methods are used to understand how languages developed and diverged.

"Mathematics is really essential since it gives a way of systematically exploring the huge space of possible evolutionary scenarios. Since evolution is a random process, probability models play an important role," he says.

In July this year, Mike was principal lecturer at a regional workshop on phylogenetics held in the USA, funded by the US-based National Science Foundation. His series of 10 keynote talks will form the basis of a book to be published in late 2015.

Recently, Mike has also been working on models of earliest life, using mathematics and computing in new ways to investigate networks. His research in this area is attracting wide international interest and has led to collaborations with

leaders in the origin of life field of research. The algorithms developed have also been applied recently to study metabolic pathways in bacteria.

In a light-hearted approach, Mike has given away cash prizes for solutions to mathematical challenges he has set, with \$US100 for each correct solution.

"The hardest challenge took a team of three smart guys from Berkeley and Massachusetts Institute of Technology many months to find a correct proof – but eventually they did.

"The reward for those who crack the problem is really much greater than \$US100 as each solution has always led to a published paper, sometimes in a high profile journal like the *Science* magazine.

Mike was recently named as one of four principal investigators to win a \$695,000 grant for a three-year research project, *Terraces, Large Trees and Trait Evolution*, funded by the National Science Foundation.

At University of Canterbury he leads the Biomathematics Research Centre, hosted within Canterbury's School of Mathematics and Statistics. Between his MSc and PhD Mike briefly enjoyed a quite different career – completing a journalism diploma at the University of Canterbury before working as police reporter on a national Sunday newspaper.



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