

AgResearch's Dr Shona Lamoureux and Dr Graeme Bourdôt (programme leader) and Scion's Dr Michael Watt, examine their potential distribution map of Chilean needle grass, a weed recently discovered in Canterbury that is a threat to livestock farming over more than 1 million hectares in the region.

Combating billion dollar weeds problem

It is estimated that weeds cost our pastoral industries at least \$1.2 billion annually. This has led to an industry and research partnership to combat the problem.

Crown Research Institutes AgResearch, Scion and Landcare Research, as well as Plant Protection Chemistry NZ Ltd, a privately-owned research, advisory and extension services provider, are working on helping pastoral farmers, forestry owners, and other primary producers, combat weeds. The programme "Undermining Weeds" is funded by the Foundation for Research, Science and Technology and industry bodies.

Programme Leader, AgResearch's Dr Graeme Bourdôt says weeds threaten the sustainability of pastoral agriculture and plantation forestry through losses in yield and product quality and management practices that do not fit with market demands and environmental certification schemes. "This research programme brings together the scientific skills needed to provide sustainable weed management solutions at a range of scales; national, regional, farm and paddock."

Scion brings expertise in the spatial modelling of weeds to predict the potential

geographic distribution of weeds, while AgResearch provides expertise in population dynamics and ecology of weeds. Landcare Research brings weed biological control expertise, while Plant Protection Chemistry is applying new understanding of how herbicides behave at the plant leaf surface.

Scion's Dr Michael Watt says working with the other research providers is beneficial to the forestry industry. "We're aware of the damage that weeds create, including in some cases causing crop failures, and this systematic co-ordinated scientific approach is having real benefits."

"What has made this work possible has been the strong partnership with AgResearch, Scion, Landcare Research, Plant Protection Chemistry NZ Ltd and the significant contributions from industry partners across the whole primary sector."

Dr Michael Watt, Scion

An example of the importance of the collaboration has been the team's response to the discovery of Chilean needle grass in North Canterbury. Naturalised in Hawke's

Bay and Marlborough for more than 100 years, the weed was discovered in North Canterbury in 2008. "Its sharp barbed seeds penetrate the hides and eyes of grazing animals downgrading wool, hides and carcasses and creating serious animal health and handling issues. Our research with Scion has allowed us to estimate that more than 1 million hectares of grassland in Canterbury is at risk of invasion by this weed, and that a programme to prevent its spread is economically justified. This has led to work with Environment Canterbury on a containment programme for the grass" said Dr Bourdôt.

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Funding partners represented on the Industry Advisory Group - shown below.



The research looked at cows preferences for keeping cool. The shade cloth this cow is using for shelter is cutting out 99 per cent of solar radiation.

New Zealand cows like shade better than showers

Summer sun has long been known to affect the health of cows and farm productivity. The issue for farmers is what is the most successful way to combat it?

AgResearch animal behaviour and welfare scientist Dr Karin Schütz and colleagues set out to determine the effectiveness of shading and sprinklers, the most commonly used ways to address heat and also measure cow preferences.

Funded by DairyNZ and the Foundation for Research, Science and Technology the project looked at Holstein-Friesian dairy cows during average air temperatures of 22.3°C. The research showed that while sprinklers were more effective at keeping the animals cool, and keeping away insects, the cows preferred shade.

"The cows showed no preference for sprinklers over standing in the sun but their preference for shade increased with higher air temperatures, increased solar radiation, and higher winds," said Dr Schütz. "We tested all the cows over three days and were surprised the cows wanted shade no matter how much cooler the sprinklers made them". The results are interesting since Dr Schütz's collaborative research with the University of California has shown that non-lactating cows used a specially designed cow shower on average, three hours per day. "We think that the previous

experience and degree of control over the water can have something to do with the choice to use water," said Dr Schütz.

Dr Adele Arnold, Animal Welfare Developer at DairyNZ, says the results are useful in demonstrating the preference cows have for shade over sprinklers; even if that option does not provide faster relief from the symptoms of heat stress.

"In the end when cows have done their afternoon walk to the dairy shed, which is the really critical window for onset of heat stress symptoms, spraying with water is still the most effective means to achieve a rapid drop in body temperature for an animal in a critical state, but it isn't always practical for all farmers.

"Farmers are also using other preventative options like grazing cows close to the dairy shed on hot afternoons so they don't have to walk as far to be milked; milking later in the evening when it's cooler, and ensuring a good supply of clean drinking water for cows during the day."

Dr Schütz thinks there is a lot more to learn; "we would like to do more work



Dr Adele Arnold (DairyNZ) and Dr Karin Schütz (AgResearch) are working on understanding why cows prefer shade even if water will keep them cooler.

on preferences for design features of water cooling, such as droplet size and impact, the role of previous experience and control over delivery."

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AgResearch Scientist Dr Jolon Dyer examines Sauvignon Blanc grape seeds with Dr Glenn Vile, General Manager New Zealand Extracts.

Business helped by science

New Zealand Extracts Ltd knew there were health benefits for skin from Marlborough Sauvignon Blanc grape seeds but their marketing needed scientific evidence to show what it was doing.

Dr Glenn Vile, General Manager of New Zealand Extracts, and a scientist himself, approached AgResearch to find out.

"We needed information on what the grape seed extracts were doing, backed by a reputable scientific organisation, so I approached AgResearch who had previously demonstrated in a clinical trial that our Oxifend® grape seed extract provides anti-ageing benefits to skin."

The preliminary grape seed study led by AgResearch Senior Scientist Dr Jolon Dyer clearly demonstrated the benefit of the extract against UV radiation-dependant damage to the skin. "We were surprised by how effective grape seed extracts are at combating protein damage from UV rays on skin. A protective effect was observed right down to the protein level. Importantly, the preliminary results indicate a significant reduction in the

level of oxidation in the skin proteins. This significant discovery suggests a huge benefit for human skin particularly given increasing concerns around UV rays," says Dr Dyer. The capability for this work builds on AgResearch's significant expertise and research understanding of keratin (wool) and collagen (meat) oxidative degradation, particularly protein modification on exposure to UV light.

Dr Vile believes this story is a great example of how science can work with business

"We knew our Oxifend® grape seed extract contains some of the highest levels of bioactives in the world, and has a number of important health benefits ranging from protecting athletes during

exercise to providing anti-ageing benefits to the skin. We didn't know why it was so good for the skin, and now we do this will really help our business".

"The good news is that grape seeds are waste products from the wine industry. Thanks to science, excellent sustainable production processes and marketing know-how the health benefits of these seeds are now going to be available world-wide to make a difference to people's lives, and that's a New Zealand success story," said Dr Vile.

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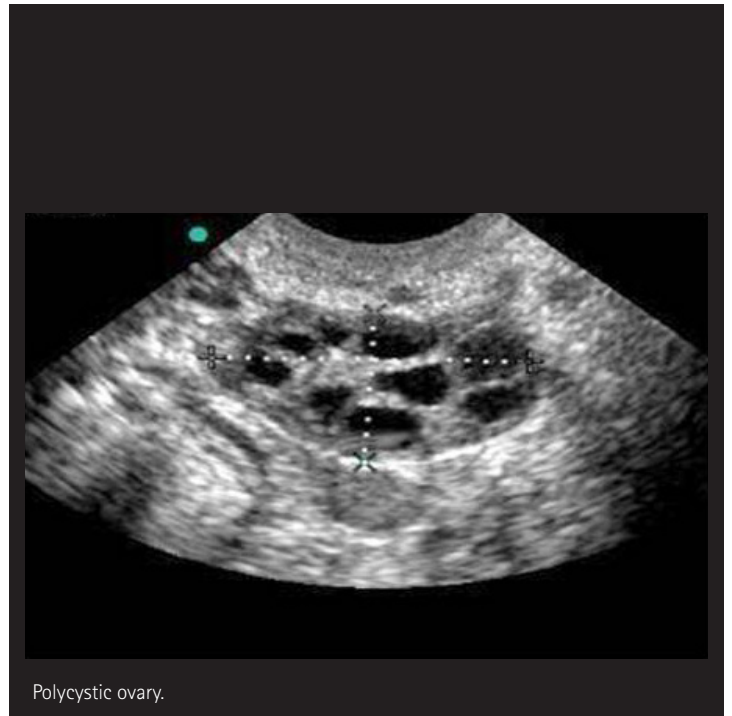
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Normal human ovary.



Polycystic ovary.

AgResearch collaborates to find causes of Polycystic Ovarian Syndrome

Collaboration between AgResearch and The University of Otago on a common cause of infertility in women could benefit farmers as well as those suffering from Polycystic Ovarian Syndrome.

The syndrome is a common disorder affecting up to 10 per cent of women worldwide and the major cause of female-based sub and infertility. It accounts for approximately 75 per cent of suppressed ovulation (anovulatory) infertility and yet the medical and scientific understanding of the causes of the disorder is limited. A newly developed sheep model now being established at the Centre for Reproduction and Genomics (CRG) may hold the key to understanding this disorder.

Peter Smith of AgResearch's Dunedin campus, Invermay, is working with University of Otago's Dr Peter Hurst under the umbrella of the Centre for Reproduction and Genomics headed by Professor Neil Gemmell. Peter says the AgResearch contribution to the project would be to use sheep to help understand the condition better. "The project also has implications for on-farm reproductive efficiency particularly in the timing of puberty. Any discoveries we make can be applied to sheep directly and improve reproduction on farms."

Dr Hurst, who has experience in human

reproduction and human ovarian development and function, says "sheep are an ideal model and in countries including the USA and United Kingdom they are being studied as their ovaries are developmentally and functionally similar to humans, much closer than say those of rodents."

Professor Neil Gemmell says the project can be targeted at making a real difference for sufferers. "The Team intends to link abnormalities seen at the level of the ovary and identify a causative change that leads to the condition, resulting in more effective treatment options. Patients with Polycystic Ovary Syndrome can have a wide range of metabolic and reproductive dysfunctions making successful treatment difficult and so this work involves putting together a strong multidisciplinary Team to confront the issues."

"The Centre for Reproduction and Genomics is a collaborative venture between AgResearch and The University of Otago and we've been able to connect to the medical school and arrange the involvement of one of New Zealand's pre-eminent clinicians in

this field. AgResearch has a world-leading understanding of sheep reproduction and sheep ovarian function and development and for six years they have been working closely with the University of Michigan, one of the world-leaders in the Polycystic Ovarian Syndrome field, who needed expertise in sheep ovarian morphology and foetal development of the sheep ovary," said Professor Gemmell.

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L to R: Marks & Spencers' Malcolm Copland (Meat, Poultry and Dairy Manager), Steve McLean (Agriculture Manager), Sue Bell (Technical Executive) and AgResearch's Dr Jimmy Suttie (General Manager Applied Biotechnologies Group), during the visit to AgResearch's Ruakura Campus.

Marks & Spencer visit AgResearch about improving supply chain through science

United Kingdom retailer Marks & Spencer (M&S) brought a delegation to meet New Zealand producers and processors who supply lamb to their business. The visit, organised by M&S, involved meeting relevant supply and processing partners.

As part of the week-long New Zealand tour, AgResearch hosted the M&S delegation and its local partners on 9 February at its Ruakura campus in Hamilton. The presentation focussed on science that can contribute to the world class supply chain that M&S has developed.

Representatives from Silver Fern Farms, Alliance Group and Beef + Lamb New Zealand attended to discuss how science can support the farm, processing, transport processors and New Zealand farmers.

M&S Agriculture Manager, Steve McLean, says the visit was to work with suppliers to make production more sustainable

through utilising best practice, reproductive technologies and animal welfare and farm systems to improve quality and build trust in New Zealand lamb. "British consumers value New Zealand lamb and we want to see how we can build on this reputation and continue to improve quality through all aspects of supply."

Dr Jimmy Suttie, AgResearch General Manager, Applied Biotechnologies, described the M&S initiative as significant, "Marks & Spencer is a major partner with the New Zealand lamb industry, and the collaborative supply chain that gets our lamb to British consumers is incredibly important to our farmers. The challenge we met to discuss

is how to use science to make the journey from New Zealand farms to the retailer more efficient, sustainable and innovative."

Particularly important was the presence at the meeting of Beef + Lamb New Zealand who contributes to most of the science research discussed using farmer levies.

The session covered animal genomics and reproductive technologies, agricultural systems modelling, meat science, food processing, food safety and animal welfare.

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Professor Hong Di of Lincoln University and Dr Cecile de Klein of AgResearch are leading the NZAGRC nitrous oxide research programme.

Nitrous oxide emissions a priority

The MAF-funded New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) announced science contracts in late January for a range of scientific research projects totalling \$15.5m over four years.

The areas of work for NZAGRC are reducing methane and nitrous oxide emissions, increasing soil carbon accumulation and developing tools needed to design novel, practical and credible farm systems that maintain/enhance profitability while reducing greenhouse gas (GHG) emissions.

The announcement included news that AgResearch's Dr Cecile de Klein and Lincoln University's Professor Hong Di will play lead roles. The pair will not only be working on their own science projects but, together, they are responsible for the NZAGRC nitrous oxide research programme.

The nitrogen work is crucial to the science to combat greenhouse gases says Dr de Klein. "New Zealand research has already demonstrated that nitrification inhibitors provide an effective way to

reduce nitrous oxide emissions from urine patches deposited on pasture. Over 80% of the national nitrous oxide emissions are derived from animal urine."

Dr de Klein's specific research for the Centre is on how nitrogen inputs can be manipulated by plant choice.

The research funded by the Centre will address the challenge of optimising these inhibitors so that their effectiveness and longevity is increased. Research is also being undertaken to better understand the relationship between urine and nitrous oxide emissions.

Work by AgResearch's Dr Susanne Rasmussen is determining what key gene targets regulate plant growth and whether growth stimulants can be developed that promote plant growth with less nitrogen.

Lincoln University's Professor Hong Di is researching how the processes around nitrification can be manipulated. "Reducing nitrogen emissions requires finding out the relationship between the main soil, microbial and environmental factors and soil and chemical processes. Understanding the effectiveness of nitrification inhibitors in reducing nitrous oxide emissions and its impact on pasture yield promises major advances and benefits in combating nitrogen emissions." The research Professor Di is leading could result in greater use of generation inhibitor technologies and recommendations for their optimal use.

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Three new AgResearch Section Managers



Dr Bram de Vos

Section Manager Climate, Land & Environment

Dr Bram de Vos started late last year as Section Manager Climate, Land & Environment bringing with him extensive experience in both soil science and in management of science. With a degree in applied physics, Dr de Vos studied water flow and nutrient transport in a layered silt loam soil for his PhD.

He then worked as the Team leader of the Nutrient Management Team of Alterra, a newly merged institute in Wageningen, in the Netherlands. Dr de Vos was involved there with helping farmers and government to reduce the nitrate loads on groundwater. Later he led the creation of a Decision Support Tool that was used by water boards and farmers to calculate and discuss the effects of different strategies of surface water management on farm economics.

Before coming to New Zealand Dr de Vos was the Operational Manager for the Soil Science Centre of the Environmental Sciences Group (ESG) of Wageningen University and Research Centre.



Dr Greg Murison

Section Manager Animal Improvement

New AgResearch Animal Improvement Section Manager Dr Greg Murison brings strong leadership experience to AgResearch. His new role provides the advantage of working at the front gate of the agricultural industry.

He comes from the role of Chief Scientist at Auckland-based Genesis Research and Development and was one of Genesis' founding scientists at the time it was started in 1994, as a collaboration with The University of Auckland.

During his 16 years with Genesis, Greg had responsibility for both establishing and changing the direction of the company and oversaw the development of RNAi therapeutics. He believes that these achievements have given him a strong grasp of science management and taking scientific discoveries through to market.



Dr Graeme Attwood

Section Manager Ruminant Nutrition & Microbiology

Dr Graeme Attwood, the newly appointed Section Manager of Ruminant Nutrition & Microbiology, completed BSc and MSc degrees at the University of Waikato and a PhD on genetics of rumen bacteria at the University of Adelaide, South Australia.

He conducted postdoctoral work at the University of Illinois at Urbana-Champaign, USA, studying cellulases from fibre-degrading rumen bacteria before returning to New Zealand in 1993 to take up a position in Rumen Microbiology with AgResearch.

Graeme formed and led the Rumen Microbial Genomics Team, which has used genomic and metagenomics approaches to characterise enzyme systems used by rumen microbes to breakdown forage material and to investigate rumen methanogens to identify specific gene targets for the reduction of ruminant methane.

Graeme is looking forward to leading the newly formed Ruminant Nutrition & Microbiology Section as it brings together three world-class Teams, tasked with understanding the biology of the rumen, relating this to the digestive functions of ruminant animals and translating this into practical advice and outcomes for farmers, agribusinesses and government policy makers.

Achievements

Dr Bruce Veit has been appointed to the "Faculty of 1,000" in recognition of his expertise in the field of plant growth and development. The "Faculty of 1,000" consists of 5,000 of the world's top scientists and clinicians whose role is to evaluate literature and identify important trends and developments in the biological and medical sciences. The faculty hosts a website for scientists, providing rankings and commentary on current scientific research papers.

Dr Phil Rolston won the Best Overall Paper Presentation at the 2010 Agronomy Society of New Zealand Conference.

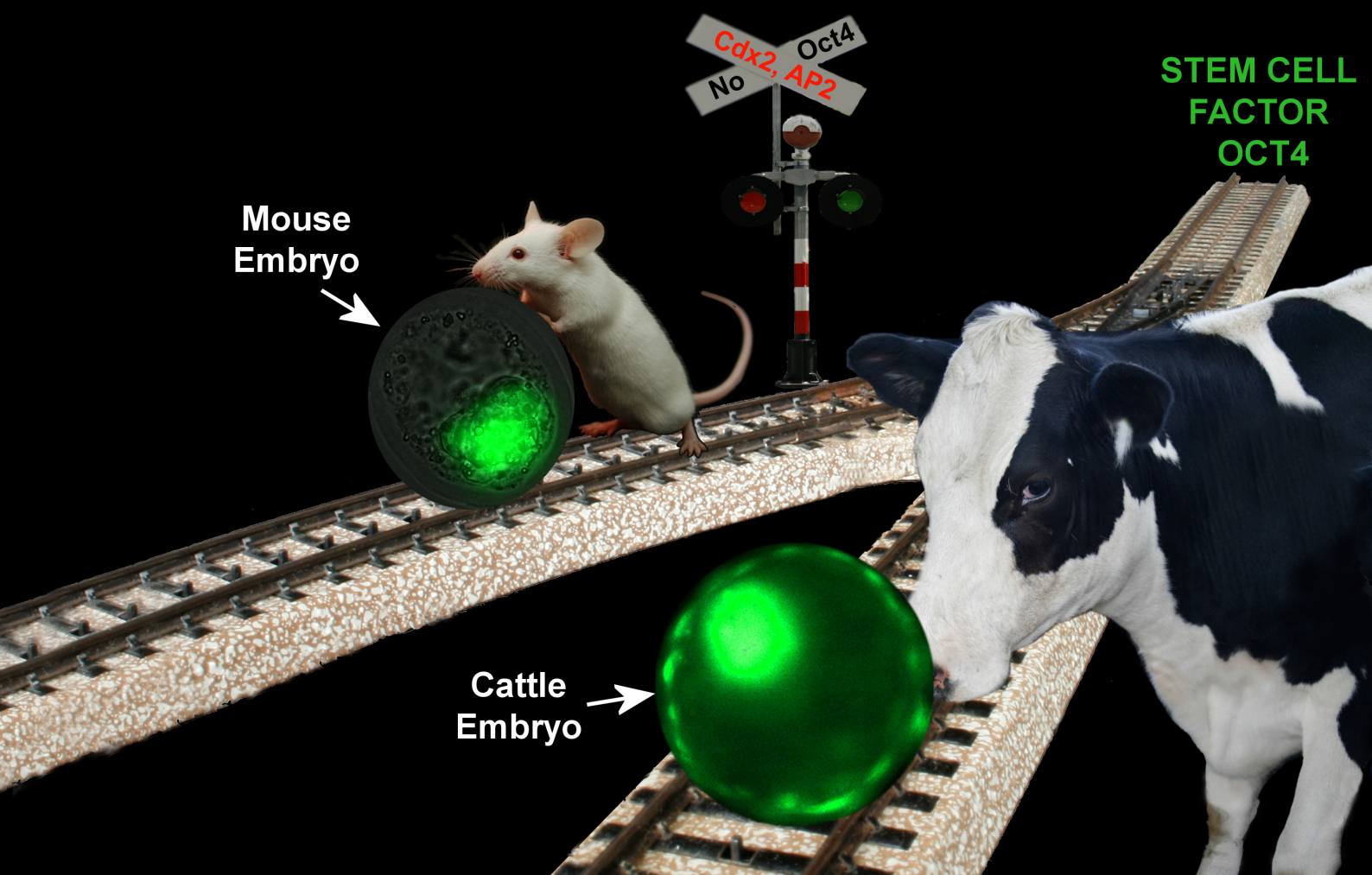
AgResearch merino wool fabrics showcased at NZ Fashion Week 2010 have made the Top 100 Innovations list in the key UK-based publication 'Future Materials'. The magazine offers the latest materials news, R&D and product launches.

This Top 100 Innovations list is seen by many companies and businesses around the world.

Dr Nicole Roy was appointed Head of the NZ Delegation to the European Union Twinning Workshop on Food and Health.

Sandeep Gupta, PhD student in the Agri-Foods & Health Section, was awarded the Graham Jackson Memorial Prize for best presented poster at the mucosal immunology section of the Australian Society of Immunology annual conference in Perth, December 2010.

Ron Xavier, PhD student in the Agri-Foods & Health Section, won second prize for his oral presentation at the NZ Microbiological Society Conference in the student competition, December 2010.



**STEM CELL
FACTOR
OCT4**

Differences in stem cell factor regulation cause cattle and mouse (early) embryos to follow separate developmental tracks.

Study shows mice not best research model for large mammal studies

In a study recently published in the prestigious journal *Developmental Cell*, it has been proved for the first time that research using mice may not be able to be reliably extrapolated to apply to large mammals, including cows and humans.

The study, funded by FRST and Marsden grants was undertaken by a team of AgResearch scientists at Ruakura, led by Dr Peter Pfeffer, including Dr Debbie Berg, Dr Craig Smith, Dr David Pearton, Dr David Wells, Ric Broadhurst and Martyn Donnison.

"Mice are the universal mammalian embryological model system on which most of our knowledge is based and it has been assumed this knowledge can be applied to humans and livestock. We were therefore intrigued by observations that in mammals such as humans, cattle, pigs and rabbits the key stem gene Oct4 was not shut down in the placental progenitor ("TE") cells of early embryos," says Dr Pfeffer. "This suggested to us that the mouse is not very representative of other mammals right from the fist lineage decision. We therefore decided to develop

cattle as a new functional mammalian developmental model system.

"Our results are significant for New Zealand farmers. For instance, to improve cows' fertility our study shows the cow is best to use as the model for research studies, not mice."

Dr Pfeffer and his team aim to improve embryo health in dairy cattle where embryo mortality has been on the rise over the last two decades.

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Left to right Martyn Donnison, Dr Craig Smith, Dr Debbie Berg, Dr Peter Pfeffer, Ric Broadhurst, Dr David Wells.

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