

# Discovery

## Searching deep for microbes

The role of microbes in producing methane is being studied by an Irish scientist, writes Jarrod Booker.

While science is helping us discover vast new worlds beyond our own, the worlds explored by Sinead Leahy are far too small to be seen by the naked eye.

This world of microbes – tiny bugs such as bacteria that could fit by the millions in the eye of a needle – are all around us and keep the planet functioning. For Leahy, a senior scientist at AgResearch, her focus over the last decade has been on the complex world of microbes in the stomachs of ruminants like cows and sheep – and the huge implications these tiny single-cell organisms have for both New Zealand's economy and environment.

"We know so little about this microbial world, because people don't see it and they don't realise how important it is to us in New Zealand. It's only recently that we have started to get DNA sequencing technologies that allow us to study these worlds with new insight," Leahy says.

"The microbes in the sheep or cow's rumen (a chamber of the stomach) powers the animal by allowing it to break down the grass it eats, and gives us the products like milk, meat and wool that New Zealand sells to the world."

Paris climate talks: NZ agricultural greenhouse gas emissions a tough nut to crack

It is not only the size of the microbes in the rumen that makes them difficult to identify and study, it's also the environment they exist in – without oxygen – and the highly complex roles they play, and how they interact with each other.

Irish-born and raised Leahy, alongside her colleagues in rumen microbiology at AgResearch, has spent the last decade in New Zea-



Sinead Leahy is part of an international project led out of AgResearch, called Hungate1000.

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While retaining her position at AgResearch, Leahy has recently taken up a new role of International Capability and Training Co-ordinator for the Government-funded New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC).

The role will support the goals of the Global Research Alliance on Agricultural Greenhouse Gases, an initiative supported by the New Zealand Government to increase collaboration between countries to reduce the emissions intensity of food production. One of the objectives of Leahy's role is to engage scientists and policy audiences in the developing world on why lowering agricultural greenhouse gas emissions intensity (the emissions per kilogram of meat, milk, vegetables or grains) is important for their agricultural production.

"It's something I haven't done before, working on that interface between governments and the science, and the area of developing policy," Leahy says.

"It's vital to have that policy in place if you want to make real change, and for that policy to be built on quality science."

## There's plenty of stretch in mozzarella

World dairy experts believe there's plenty of stretch left in the science that has made mozzarella a New Zealand success story.

They are predicting more "ground-breaking scientific and technological advances" from dairy co-op Fonterra's food structure programme that will benefit the economy and help grow the country's talent pool in R&D.

The panel – comprising global dairy science leaders Professors Allen Foegeding, from North Carolina State University; Erich Windhab, from ETH Switzerland; Jason Stokes at the University of Queensland; and Dérick Rousseau from Canada's Ryerson University – meets every year to review the science and the progress of Fonterra's food structure programme.

In a report released after their latest gathering the scientists said the approach to the mozzarella cheese innovation had produced an "exceptional amount of success".

The panel is encouraging the co-op to stretch the science further in the pursuit of new value-add products. It says the "scientific approach to mozzarella could be used as a model and directly transferred to other applications, including cream cheese and beverages, with expectations of equal success". That approach included "attracting top international scientists to New Zealand academic institutions and Fonterra", and looking "out of the box" for innovation. This and other initiatives would "help ensure

world leadership in dairy science". Much of the work in the food structure programme is supported by the Transforming the Dairy Value Chain (TDVC) Primary Growth Partnership programme, a seven-year, \$170 million innovation investment led by commercial partners, including DairyNZ and Fonterra, and partnered by the Ministry for Primary Industries.

The programme aims to enable the creation of new dairy products, increase on-farm productivity, reduce environmental impacts, and improve agricultural education. The panel praised Fonterra for its approach.

"It is impressive to see a company of this magnitude believe in the synergistic relationship that



AgResearch scientists Sinead Leahy and Christina Moon in the laboratory.

proud of its rugby players and rowers, they should also recognise that in areas like rumen microbiology, New Zealand is a world leader, she says.

Though she and her Irish-born husband are now also New Zealand citizens, along with their two New Zealand-born children, there is no question where her loyalties lie when it comes to the rugby arena. She looks back on the famous Irish victory over the All Blacks in Chicago last year as "one of the greatest days of my

life". "It was a long time coming. After all the pain of the last 10 years, I finally got to come to work in my Ireland jersey and lord it over everyone for a change."

Leahy, 38, was one of nine children growing up in the Irish town-ship of Bilboa – she had more siblings than there were pupils in her primary school class. Her grandfather's small farm nearby had her exposed early to rural life – "we grew up with milk straight from the cow".

Her family was very strong in mathematics, and she remembers telling them at a young age she was going to be a researcher. "I remember in primary school a teacher turning water with different colours with dye. It basically set me on the path from there."

After completing her PhD in Cork, Leahy arrived in New Zealand in 2006, for what she told family and friends was part of a two year adventure around the world. After landing the job at AgResearch, and becoming attached to the work, her team, and the lifestyle, she decided to

further develop its creams, cream cheese and beverages. "This approach has helped us build an integrated research programme that covers engineering and science aspects of making a product with desired performance, including figuring out what drives the performance," Taylor said.

An important part of that approach was the strong relationship between overseas experts, the co-op's external research partners and its own scientists. "The rich discussions at the reviews have helped shape the work being done, and the interpretation of results," he said. "This has been particularly important in areas where Fonterra has less internal expertise and has been very inspiring for our researchers."

couple sound, basic science and superb training of scientists with targeted economic outcomes," the panel said of the co-op.

Food Structure design programme manager Christina Coker said the co-op's material science approach in mozzarella was deliberate. "It's aimed at developing a sound knowledge of the link between mozzarella structure, material and functional properties, and the process used to make it," she said. "Some fantastic work by talented post-grad students, post-docs and Fonterra researchers has seen significant advances that can be applied in future processes."

Food Structure technical manager Steve Taylor said the co-op was heeding the panel's advice and using the knowledge gained through the mozzarella work to