

OUR INNOVATIONS FOR A HEALTHIER FUTURE

**NEW SCIENCE-LED DAIRY
INNOVATION WILL
BENEFIT THE INDUSTRY
AND THE NZ ECONOMY**



COLLABORATIVE WORK BY THE RIDDET INSTITUTE, EXPERTS IN FOOD SCIENCE RESEARCH, AND FONTERRA, NEW ZEALAND'S LARGEST DAIRY PRODUCER AND EXPORTER, HAS RESULTED IN SUBSTANTIVE INNOVATIONS THAT REVOLUTIONIZE THE MOZZARELLA MANUFACTURING PROCESS WHILE MAINTAINING HIGHEST PRODUCT QUALITY. CURRENTLY, NEW ZEALAND'S MOZZARELLA CHEESE EXPORTS ARE WORTH \$222M PER ANNUM. IT IS A RAPIDLY GROWING MARKET.



EXPORTS, NEW ZEALAND'S ECONOMIC LIFE BLOOD



NEW ZEALAND'S ECONOMIC PROSPERITY LEANS HEAVILY ON THE COUNTRY'S EXPORTS. DAIRY IS NEW ZEALAND'S MOST SIGNIFICANT INDUSTRY AND MAKES UP A SUBSTANTIAL PROPORTION OF THE APPROXIMATELY 66% OF NEW ZEALAND'S AGRI-FOOD SECTOR EXPORT EARNINGS.

Collaborative research between the Riddet Institute and Fonterra establishing the fundamental food material science relating to structure-product-process interactions in dairy food systems was used to iteratively model the properties of mozzarella cheese, whether during manufacture, storage or usage, as part of Fonterra's Transforming the Dairy Value Chain Primary Growth Partnership with the Ministry of Primary Industries. This has supported Fonterra's \$240m investment in a new mozzarella manufacturing plant at Clandeboye, and is now pointing to even further process and product enhancements in the next generation of mozzarella manufacture. Current export revenue from mozzarella is \$222m p.a. Implementation of research outcomes from the Riddet Institute and Fonterra collaboration will substantially grow that export revenue.

Two pieces of mozzarella cheese are shown. One is a whole ball of cheese, and the other is a smaller ball of cheese with a piece of string tied around it. The cheese is a light yellow color and has a smooth, slightly glossy texture.

WITH THE PROSPECT OF EVEN FURTHER INNOVATION, FONTERRA HAS INVESTED \$240M IN WHAT WILL BE THE SOUTHERN HEMISPHERE'S LARGEST MOZZARELLA MANUFACTURING PLANT, POSITIONING THE COMPANY TO SUBSTANTIALLY GROW EXPORT REVENUE.

› A collaborative endeavour

The New Zealand Government has prioritised increased exports as the main vehicle to generate growth in the economy. The Ministry of Primary Industries has set a goal of doubling primary industry exports in real terms from \$32 billion in June 2012 to over \$64 billion by 2025.

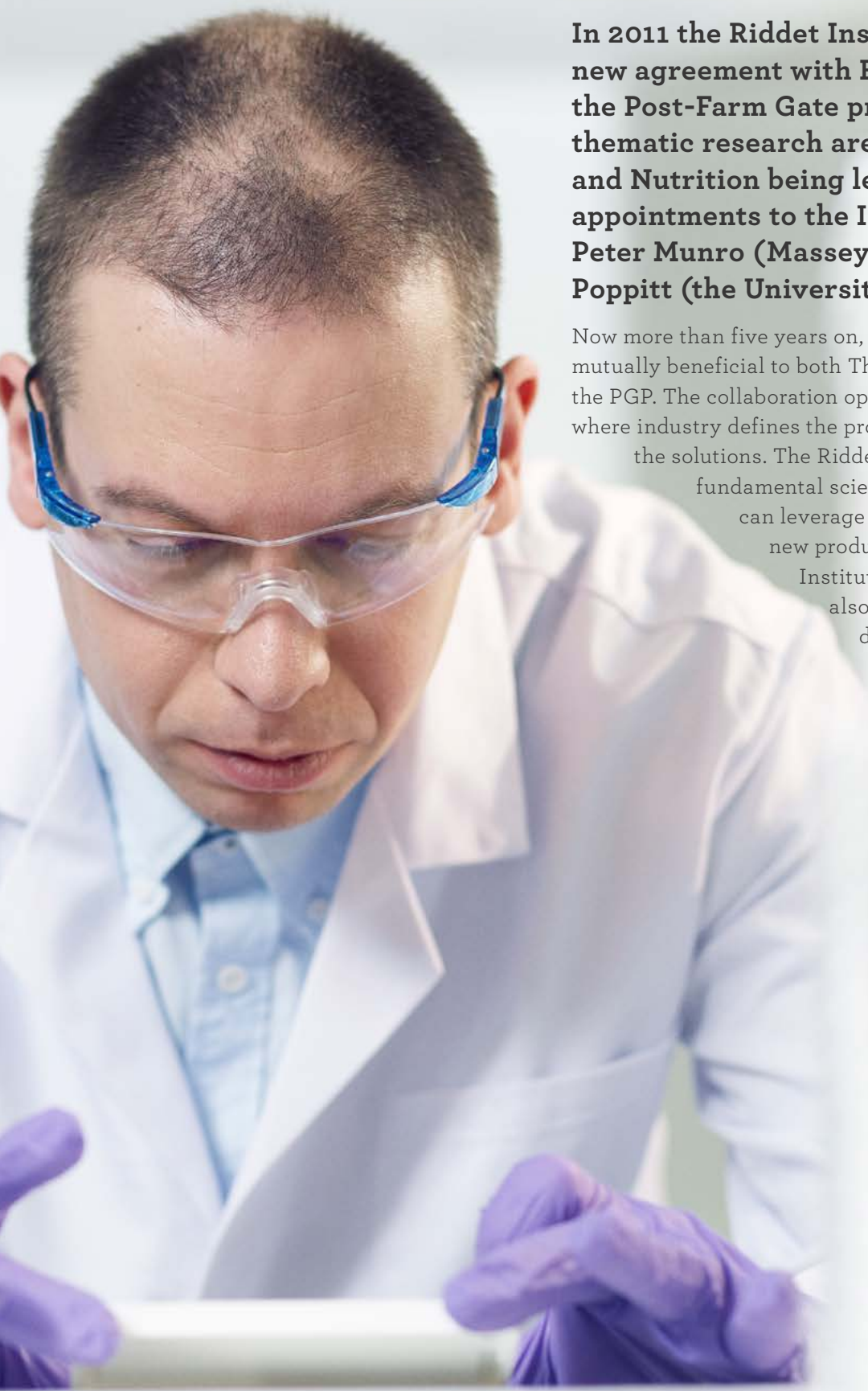
To support this goal the Government is investing in a range of Primary Growth Partnerships (PGPs) to help drive innovation across the primary sector. Transforming the Dairy Value Chain is the PGP programme aimed at creating new products, increasing on-farm productivity, reducing environmental impacts, and improving agricultural education. Established in 2011, this PGP aims to boost the country's export earnings by \$2.7b per annum, and is backed by an investment of \$170m, 50% funded by government and 50% by industry.

Transforming the Dairy Value Chain has two areas of focus: Pre-Farm Gate and Post-Farm Gate. Fonterra, New Zealand's largest manufacturing and marketing business, is leading the Post-Farm Gate programme.

Fonterra involved the Riddet Institute from the PGP programme's conception as the areas covered by the programme align closely with The Riddet Institute's highly regarded expertise in food science. As a Centre of Research Excellence (CoRE), the Riddet Institute brings to the table science excellence, world-leading science capabilities, national and international networks, international credibility and an ethos of collaboration.

Fonterra and the Riddet Institute already had a long-standing association. With both entities having their research bases in Palmerston North, there have been natural collaborations occurring over the years. More formally, in 2006, research undertaken for Fonterra was covered by a Master Research Agreement as a means of growing mutual trust and accountability. Fonterra has also funded the Fonterra Chair of Dairy Science since 2001, which supports a leadership role in food and dairy science at the Riddet Institute.





In 2011 the Riddet Institute developed a new agreement with Fonterra to deliver the Post-Farm Gate programme with thematic research areas of Food Structure and Nutrition being led by two new appointments to the Institute, Professors Peter Munro (Massey University) and Sally Poppitt (the University of Auckland).

Now more than five years on, the association is proving mutually beneficial to both The Riddet Institute, Fonterra and the PGP. The collaboration operates on the team principle where industry defines the problems and researchers develop the solutions. The Riddet Institute has developed

fundamental science capabilities that Fonterra can leverage into both new technology and new product development. The Riddet

Institute, as a strategic partner, has also been able to influence the direction of research in the PGP.

Riddet Institute Principal Investigators are included on the Fonterra Science Advisory Board that provides rigorous science oversight of PGP projects to ensure veracity of the work and to monitor performance. The Institutes research capabilities are utilised which enables investigators to pursue applied research that leads to commercial outcomes and economic benefits for New Zealand.

› The mozzarella model

According to MPI data, shredded cheese exports – mozzarella cheese – were worth NZD\$222m in 2015. This is a rapidly growing food category for New Zealand with a compound annual growth rate of just over 20%. With such obvious potential, Fonterra's mozzarella cheese manufacturing became the first area of focus for the PGP collaboration between Fonterra and The Riddet Institute.

The starting point was building an understanding of the food material science and the processing of the cheese. Professor Peter Munro, the inaugural Fonterra Chair in Food Materials Science at the Riddet Institute, developed a model that integrates research supporting the development of food structures that deliver the desired consumer sensory perception and acceptance (on page 06). The model was first put to work on Fonterra's development of mozzarella cheese manufacturing process

Normally, the cheesemaking process, which incorporates biological fermentation, takes three months. The initial technology developed by the PGP team enabled mozzarella to be produced in six hours, using a 'straight through' manufacturing process.

Three areas of research by the Riddet Institute contributed to the results.

Professor Matt Golding (Riddet Institute PI; Massey University) led the exploration into how the dynamics of colloidal structuring during manufacture could control the material and functional properties of the cheese.



Professor Peter Munro (Riddet Institute Fellow; Massey University) led the work on the process engineering and product rheology of the cheese manufacture, determining how processing conditions would impact on the assembly of cheese structures during manufacture, and how this in turn would influence the functionality of the cheese.

Professor John Bronlund (Riddet Institute PI; Massey University) led the work tasked with modelling of heat transfer and cheese melting in a pizza oven, thereby demonstrating how changes to the material properties and appearance of cheese during baking could be related back to structural characteristics generated through formulation and process design.

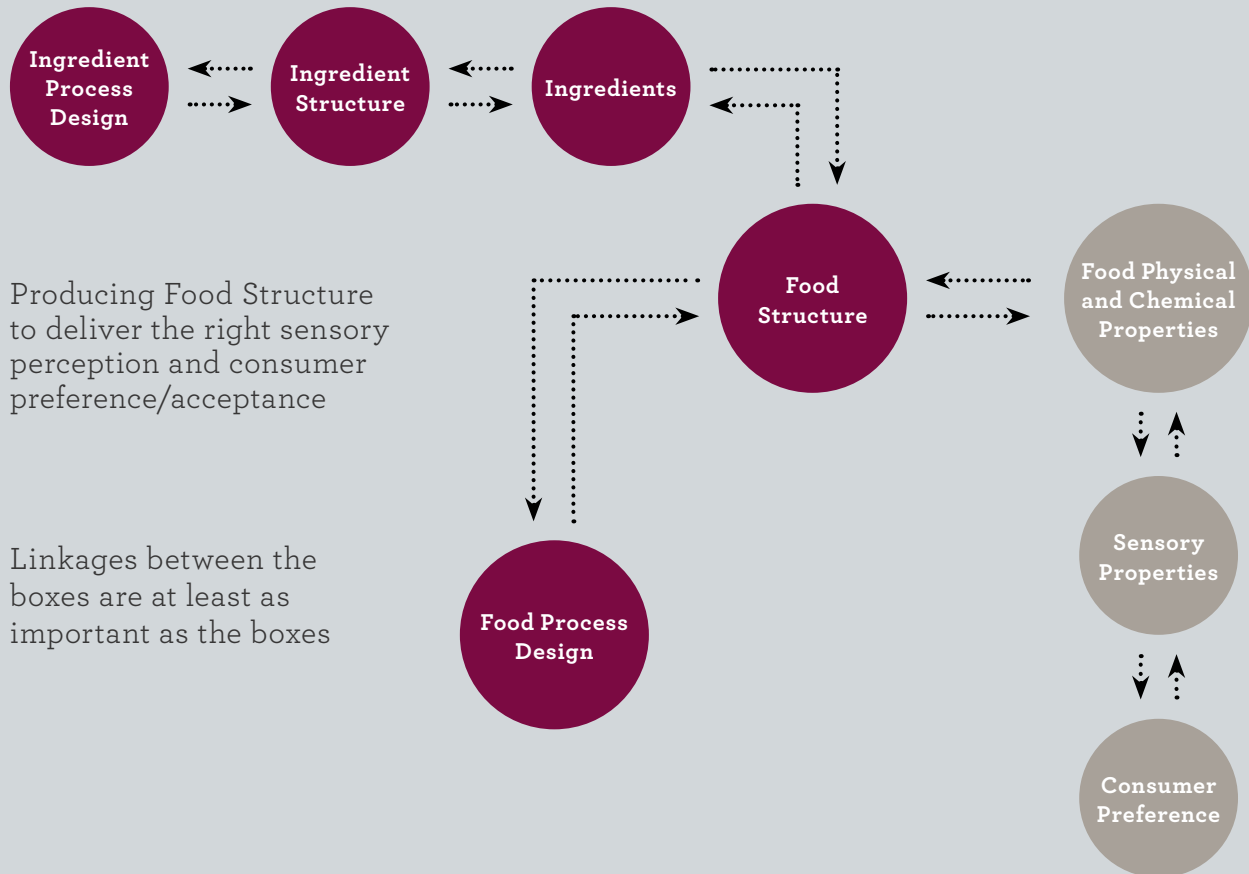
Each research strand delivered on the core objective of the PGP programme – that the

determination of structure-product-process interactions could iteratively model mozzarella cheese properties, whether during manufacture, storage or use. Further, the fundamental research carried out in these three strands was able to be meaningfully applied to technical and commercial processes.

Close and productive involvement with staff from the Fonterra Research and Development Centre (FRDC) ensured the work was commercially relevant and, ultimately, successful.

On the basis of this development, Fonterra had the confidence to invest \$240m in a specialist mozzarella factory in Clandeboye, near Timaru. When commissioned in 2017 it will be the Southern Hemisphere's largest mozzarella manufacturing plant and will feature uniquely new dairy processing technology.

› Model for integrating research to support the development of new foods (Professor Peter Munro; Fonterra Chair in Food Materials Science at Massey University)



“... we believed we had a great technology... We realised that to take that great technology to commercial reality on a large scale we needed a better understanding of the fundamental structure of the cheese. We needed to build a body of science and technology that linked the changes that occur during the cheese-making process to the performance of the cheese all the way through to the consumer experience on the final pizza. For that to happen Fonterra needed a partner able to see the opportunity for the industry and economy, one willing to support that build in capability by investing in different scientific disciplines that aligned with the co-ops traditional strengths. The Transforming the Dairy Value Chain Primary Growth Partnership was that crucial support.”

Andrew Fletcher,
General Manager External R&D, Fonterra

› Growing the innovation

While the development was a significant advance in food material science, The Riddet Institute determined that there was opportunity to investigate the science and technology behind the innovation further.

Traditionally, commercial mozzarella manufacturers have focused on meeting functional requirements specific to markets and customers. The mozzarella from other large food companies that are Fonterra's main competitors, has a higher moisture content, which is achieved through things like the addition of starch - an undesirable addition to discerning customers. Thus, there is a technology gap and therefore market opportunity for Fonterra in pursuing innovations that will see the development of a third-generation mozzarella process. With this third-generation of mozzarella science and technology, Fonterra will be able to position itself as a global technology leader in this sector of food service with significant revenue and profit growth potential.

› A partnership for the future

As opportunities arise, Fonterra's strategic focus shifts. To resource its changing focus and provide the surety for its future investments, the company is supporting a new professorial appointment in Sensory and Consumer Science, being taken up by The Riddet Institute's Professor Joanne Hort.

“The partnership between Fonterra and the Riddet Institute, and between CoRE and PGP funding in the mozzarella developments has been a tremendous example of the power of collaboration between fundamental science and commercial application. The teams have worked across these dimensions, with boundaries often blurred, in a dynamic and holistic way rather than in a simple linear knowledge transfer way. It has worked spectacularly well with substantial economic, commercial, reputation, scientific and academic benefits for the Riddet Institute, Fonterra and New Zealand”.

Mark Malone, Director,

Global Portfolio & Tech Platforms, Fonterra

› About the Riddet Institute

The Riddet Institute is a New Zealand government-funded Centre of Research Excellence. The Institute brings together New Zealand's leading scientists in food and nutrition in a collaborative, multidisciplinary national network. Partners include Massey University (host partner), the University of Otago, The University of Auckland, AgResearch and Plant & Food Research. The Institute's research programme is focussed on the effect of food structure on digestion and health, and through its work, it aims to be a catalyst for innovation to create sustained competitive advantage for New Zealand's food industry.



› The Riddet Institute Partners



Riddet Institute, Massey University, Private Bag 11 222,
Palmerston North 4442 / Phone: +64 6 951 7295 / info@riddet.ac.nz