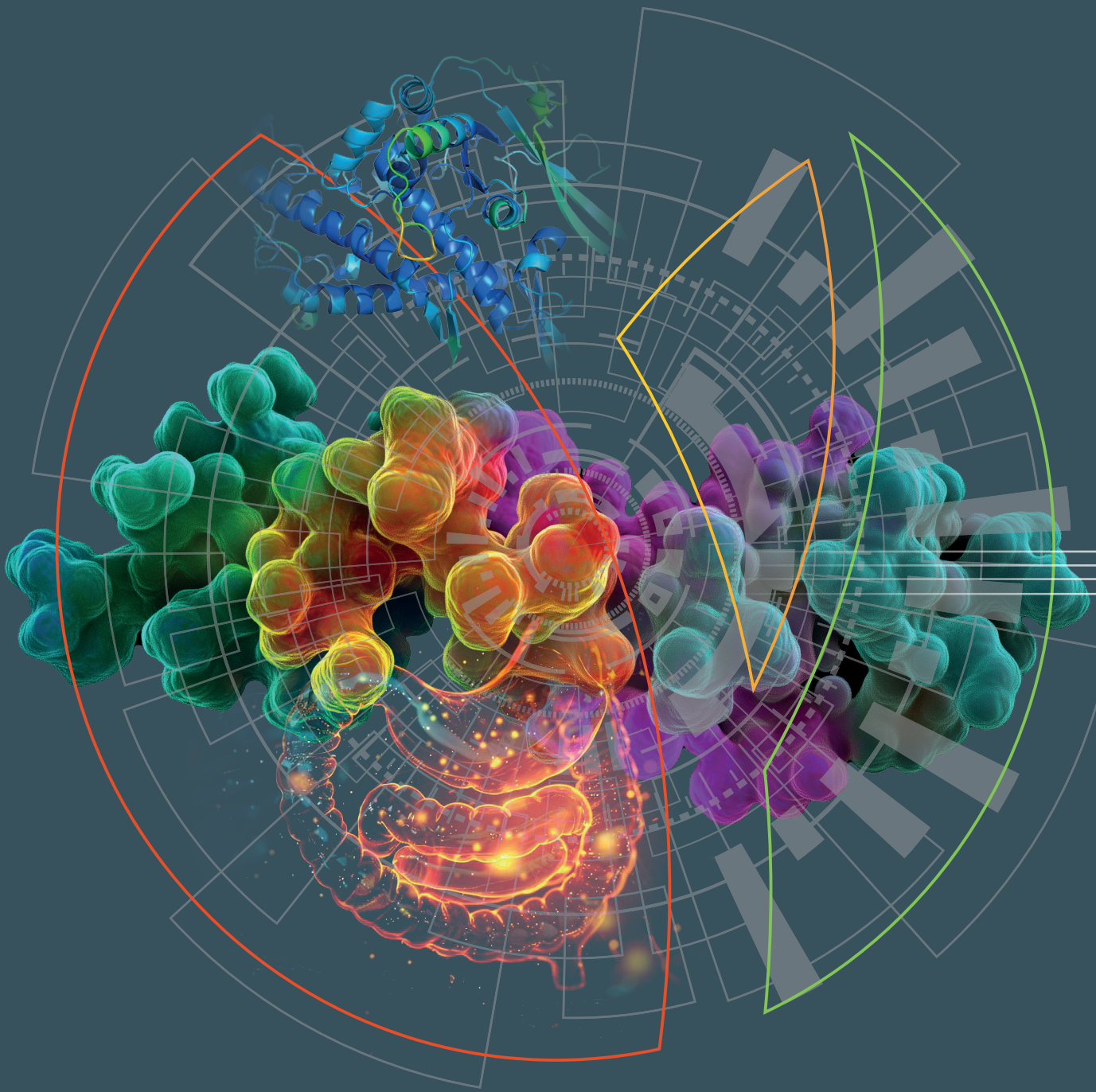
Riddet Institute

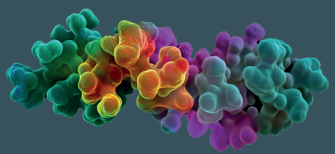
Kōkiri – Te Hīkoi te Kai

A NEW ZEALAND CENTRE OF RESEARCH EXCELLENCE
HOSTED BY MASSEY UNIVERSITY

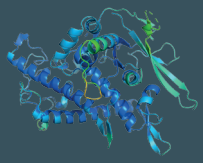
FOCUS

20 ANNUAL 24 REPORT





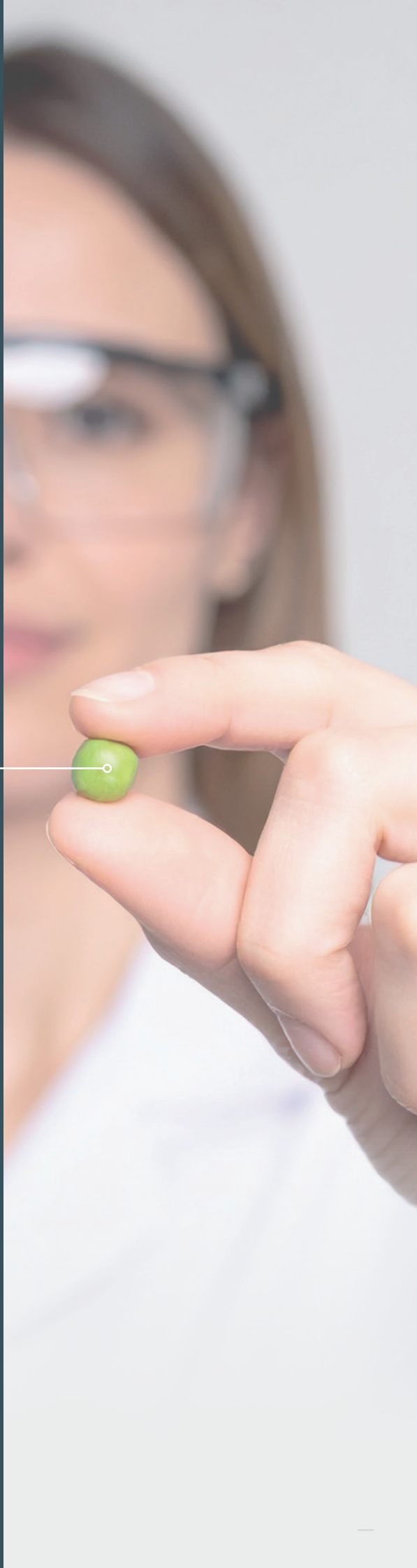
Ai generated, d-protein structure peptide molecular model



AI generated tertiary structure for protein function

OUR VISION

The Riddet Institute will be the world's top institute in discovery-led research at the frontier of food materials science, nutrition and health, developing knowledge and skills for a vibrant food sector in Aotearoa New Zealand and helping to address the challenges facing the global food sector.



OUR CORE VALUES

THE RIDDET INSTITUTE OPERATES UNDER A SET OF CORE VALUES:

- Strive for excellence in all activities and endeavours.
- Operate ethically and with integrity.
- Be collaborative and inclusive, sharing knowledge and resources for mutual benefit.
- Be committed to its responsibilities under Te Tiriti.
- Embrace equity and diversity, and support inclusion.
- Pursue research and training that supports both commercial and public good outcomes.
- Create an enduring global network of scientists to facilitate knowledge transfer across disciplinary boundaries.

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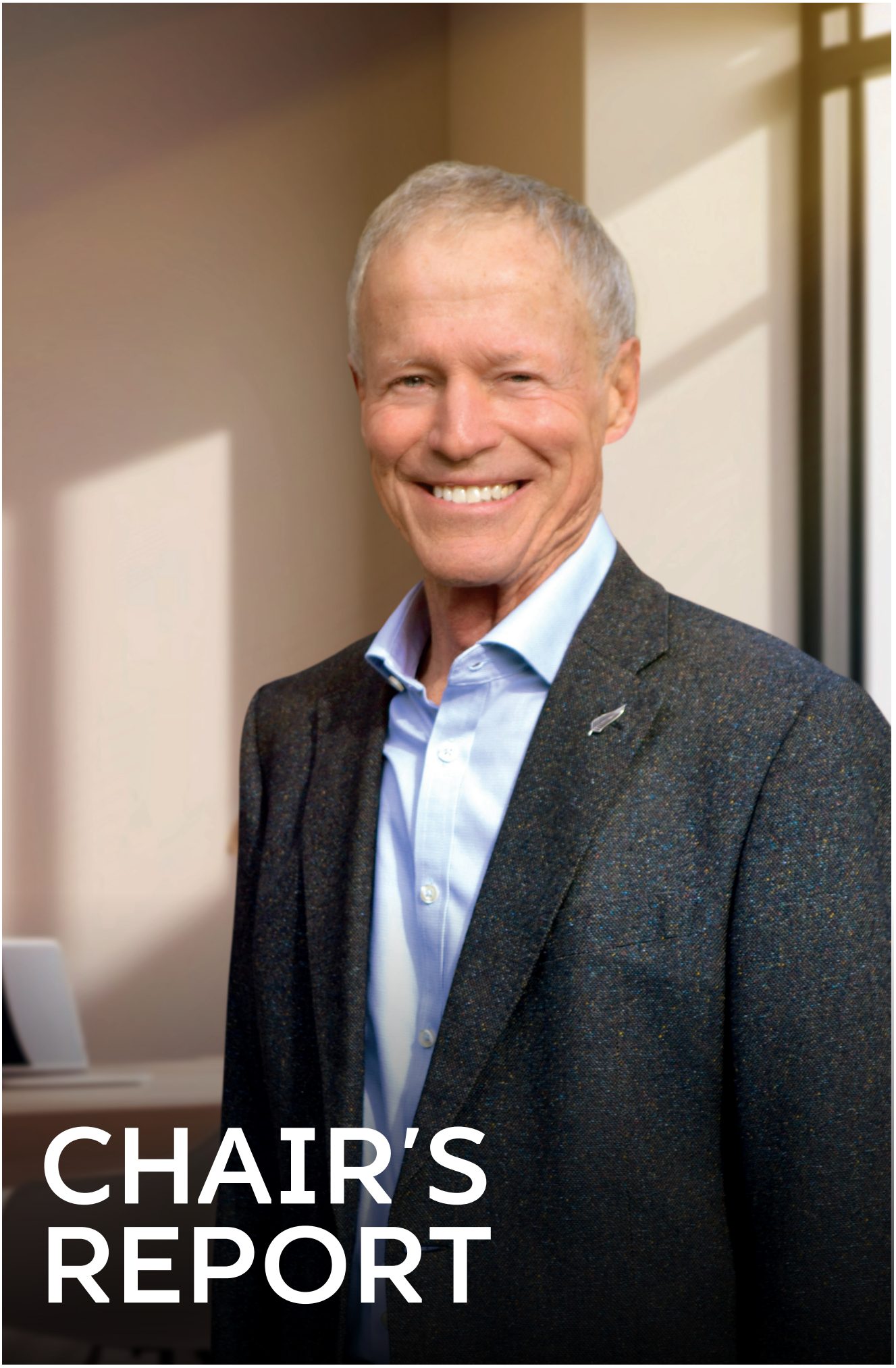
This report summarises the achievements and outputs of the Riddet Institute Centre of Research Excellence for the period 1 January 2024 to 31 December 2024



CHAIR'S REPORT

Kia ora koutou,

2024 saw the Riddet Institute stand tall on the global stage of food science. For the first time ever the Riddet Institute hosted, at Massey University in November, the top-level food science event, the 17th International Hydrocolloids Conference.

Two hundred scientists from 20 countries were able to participate, their work so important as hydrocolloids are significant building blocks of food - influencing texture, flavour, shelf life, digestion and nutrition.

That the Conference was hosted by the Riddet Institute was a tribute to the lifetime contribution, and international standing, of Riddet Director, Distinguished Professor Harjinder Singh.

Recognition of his achievements was a highlight of this past year. In March, Harjinder was honoured as the first ever recipient in Australasia of the Lifetime Achievement Award of the American Institute of Food Technologists.

That was followed in November by the award of the prestigious Pickering Medal by the Royal Society Te Aparangi. The citation emphasised his work finding solutions to iron deficiency and food innovation.

Iron deficiency, affecting more than 1.6 billion people globally, has long defied attempts to remedy it. Harjinder's patented iron-protein complex, FerriProTM, overcame the problems of lipid oxidation and protein coagulation. A major licencing deal with Nestle now sees the product poised to enhance the health of millions worldwide.

As if that wasn't enough, here at home, Harjinder was also key to the launch of start-up ANDFOODS in the plant-based milk market. Nominated for the Entrepreneurial & Emerging Business category of the Manawatu Business Awards, ANDFOODS was also a finalist in the 2024 KiwiNet Research Commercialisation Awards.

Little wonder Harjinder was made a Companion of the New Zealand Order of Merit in the 2025 New Year Honours. The Board and I wholeheartedly congratulate Harjinder and thank him for his extraordinary leadership. He continues to bring great mana to the Riddet Institute and to Massey.

His team has also achieved excellent results in the past year. Led by Prof Warren McNabb, the Sustainable Nutrition Initiative has been funded by Gates Foundation to develop a food security model for Kenya. Years of research on the nutrients needed for an adequate diet back this international work. It also underpins a new project here at home on a sustainable food system for New Zealand, Kai anamata mo Aotearoa.

Part way through the year, we were fortunate to have Distinguished Professor Paul Moughan accept the role of Acting Director, as Harjinder took temporary leave. Paul is also world renowned for his food science research, particularly protein metabolism. In 2023 he chaired the International Symposium on Dietary Protein for Human Health at Utrecht in the Netherlands.

I'm personally looking forward to the proposed Agrifood Summit to be held later in 2025 that, under Paul's leadership, the Institute is planning.

The Summit will be important as the world is likely to need some 70% more food to meet the nutritional requirements of the growing global population by 2050. So, my message to young Kiwi students is this – in solving the challenges facing humanity, food science is at the heart. The Riddet Institute is at the leading edge. Join our post-graduate programme – it's an opportunity to make a real difference.

Ngā mihi

Rt Hon Sir Lockwood Smith
KNZM, PhD
Chair, Riddet Institute

> "The world is likely to need some **70% more food** to meet the nutritional requirements of the growing global population by 2050."

DIRECTOR'S REPORT

Tēnā koutou katoa,

It is my pleasure to bring you this 2024 report in my capacity as Acting Director of the Riddet Institute. It has been another year of notable milestones.

With Dist. Prof Singh taking leave for the second half of 2024, I have been pleased to be available to take on a leadership role until his return. Here I have had a view from the front-row seat of the year's achievements and activities.

Although concerning economic challenges continue to impact research funding, the Riddet Institute has been able to garner continued support for its research programmes. The Institute is on track to deliver the outcomes and impact envisaged in its original plan; and our research continues to prove its relevance to the big questions of our time.

Some of the pressing issues we face include how to improve the health of humanity and feed a growing world population sustainably in the decades to come. Our food scientists are working hard to solve these challenges and are making significant breakthroughs along the way.

The Riddet Institute adds enormous value to New Zealand's agrifood sector, which in our country has long been a science- and technology-driven industry. Let me give you just two examples of many.

A collaboration between Fonterra and the Riddet Institute, funded by the former Primary Growth Partnership programme, led to a new technology to rapidly produce mozzarella cheese direct from milk enabling this highly functional cheese to be shredded, frozen and packed within the same day rather than the six weeks or more it took previously. The product is now produced in a custom-built plant at Fonterra's Clandeboye factory.

In other Institute work, sustained fundamental research over several years on the physiology of protein digestion in humans has paved the way for an accurate description of the protein quality rating of foods: This has culminated in the Food and Agriculture Organization of the United Nations (FAO) formally recommending the new method. The work has profound implications for maternal and child health, and independent economic analysis from the USA demonstrates value to the food industry totalling billions of dollars.

Evidence of the global standing of our fundamental science continues to be seen in the accolades our staff and investigators have received, their continued invitations to appear as keynote speakers to international audiences around the world, and their impressive publishing tally in prestigious academic journals. A range of industries continue to support the acquisition of knowledge by providing research grants, and significant support has also come by the way of philanthropic entities such as the Gates Foundation.

The Riddet Institute's coup in hosting the 17th International Hydrocolloids Conference in November was not merely by chance. The Riddet Institute attracted the conference to New Zealand for the first time and was given the prestigious honour of hosting because of our outstanding excellence in hydrocolloids research, led by Riddet Institute Director Dist. Prof Harjinder Singh.

Indeed, Dist. Prof Singh's research excellence was something of a defining theme of the year, as he continued to garner awards and attention throughout 2024, culminating in news of a New Year's Honour on the eve of 2025. I congratulate him for leading in excellence.

I would like to also thank our board, and all our staff, researchers and students whose efforts have built upon our successes, and who contribute to the Riddet Institute's continued trajectory at the forefront of food and nutritional science.

Paul J Moughan
PhD, DSc, Hon DSc, FRSNZ, FRSC
Distinguished Professor
Fellow Laureate
Acting Director, Riddet Institute

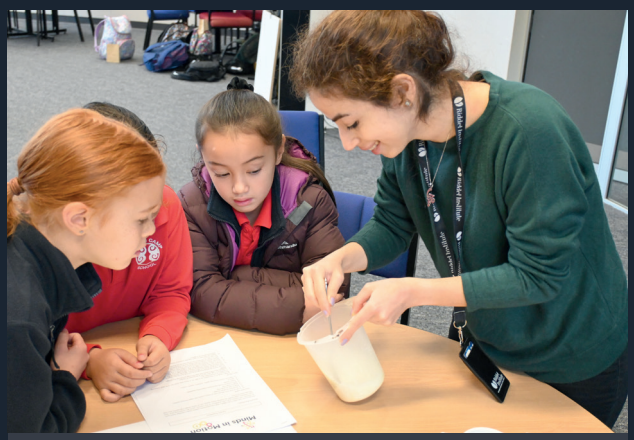
> "The Institute is on track to **deliver the outcomes and impact** envisaged in its original plan."

HIGHLIGHTS

JANUARY- DECEMBER 2024

→ A year of honours for Riddet Institute Director

Riddet Institute Director, Distinguished Professor Harjinder Singh received several prestigious honours in 2024, highlighting his standing and influence in food science globally. He was awarded the IFT Lifetime Achievement award for his pioneering research in food colloids, protein functionality, and digestion. The Pickering Medal from Royal Society Te Apārangi recognised his technological innovation, notably the development of FerriPro™ to combat iron deficiency. He was also appointed a Companion of the New Zealand Order of Merit for his outstanding contributions to food science and service to the nation's research and food sectors. Additionally, Prof Singh was a finalist at the KiwiNet Awards, celebrating his work in translating research into real-world solutions.



→ Engaging Linton Camp school's young minds

Riddet Institute staff helped to host students from Linton Camp School for a hands-on science workshop. The session explored the science behind freeze-dried ice cream and the role of visual cues in flavour perception as well as demonstrating how milk can be used to create plastic. The workshop provided an engaging learning experience, inspiring curiosity in the next generation.

→ Riddet Institute in spotlight at Yili's milestone event

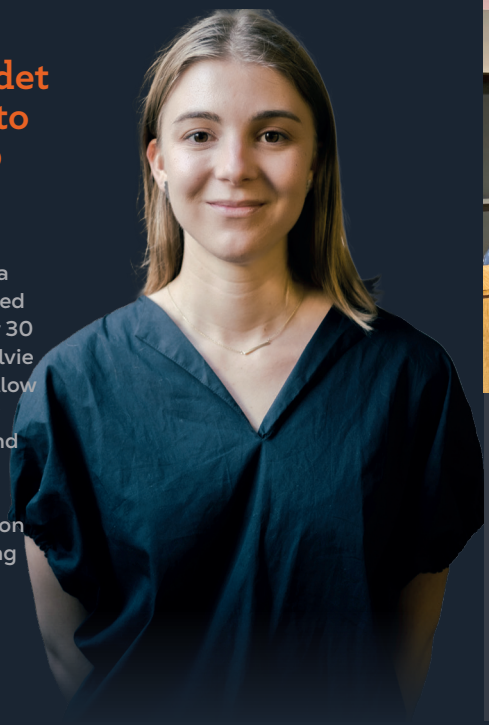
In April 2024, Distinguished Professor Paul Moughan was invited by Yili to officiate at the opening of the upgraded Yili Innovation Centre Europe (YICE) at Wageningen University & Research, Netherlands. The event marked the 10th anniversary of YICE and the establishment of the Yili Maternal and Infant Nutrition Institute (YMINI) Global. Dist. Prof Moughan's world standing in maternal and infant nutrition was central to this significant occasion.

→ Prestigious award for exceptional contributions to food research

Riddet Institute Scientific Adivsory Panel member Professor José M. Aguilera, was honoured with the Dr. Isaac Heertje Distinguished Scientist Award at the 6th Food Structure and Functionality Symposium in Bruges, Belgium. Professor Aguilera, Emeritus Professor at Pontificia Universidad Católica de Chile, has made significant contributions to food research, particularly in the area of food microstructure. His work, with over 230 publications and 13 books, continues to shape global food science.

→ From Riddet Institute to Forbes 30 Under 30

Riddet Institute alumna, Dr Olivia Ogilvie was named Forbes 30 under 30 for 2024. Dr Ogilvie is a Research Fellow at the University of Canterbury and the co-founder of Opo Bio, a startup focused on biomanufacturing innovation.



→ 2024 Harraways award celebrates excellence

Riddet Institute Fellow and Distinguished Professor Emeritus Dr R. Paul Singh was honoured with the 2024 Harraways Visting Professorship award. As part of the award, Dr Singh delivered an insightful public lecture at the University of Otago on 'Framing the Future of our food system in the era of climate change.'

→ $2.7M funding boosts ANDFOODS's dairy-free creations

Riddet Institute spin-out company ANDFOODS secured $2.7 million in funding to develop its innovative products. The company is on the verge of commercially releasing its innovative dairy-free creams and milk powders, developed using a fermentation process pioneered at the Riddet Institute.

→ Riddet Institute scientists recognised as among the best

Seven Riddet Institute scientists have been named among the top scientists in food chemistry by US-based academic platform, Research.com. Distinguished Professor Harjinder Singh ranked 3rd in New Zealand, while Professor Keith Gordon secured the 7th spot. Professors Aiqian Ye, Geoffrey Jameson, Skelte Anema, Siew Young Quek, and Juliet Gerrard were also listed in the top 40.

→ A bright mind, a global stage, a prestigious win

Riddet Institute scientist Dr Thomas Do was awarded the prestigious International Union of Food Science and Technology (IUFoST) Young Scientist Award, the highest honour awarded to Young Scientists by IUFoST for his research on the effects of heat treatment on the microstructure and hydrolysis of protein bodies from hemp. As part of this award, Dr Thomas presented at a plenary session at the IUFoST World Congress in Italy.

→ Award-winning research in dairy science

Riddet Institute scientist Dr Natalie Ahlborn was awarded 2nd place in the prestigious International Dairy Federation (IDF) Professor Pavel Jelen Early Career Scientist prize for her research on how milk processing impacts digestion and nutrient absorption.

→ $853k grant fuels research on food perception in the brain

A research team led by Riddet Institute Associate Investigator Dr Mei Peng (University of Otago) in collaboration with researchers at the University of Auckland and the University of Oxford, has secured an **$853,000** Marsden Fund grant to investigate how the brain perceives food. Using advanced neuroimaging, the study will explore how visual, olfactory, and gustatory cues shape food perception and eating behaviors. These findings will provide new insights into sensory processing and dietary choices.

→ International Science Council welcomes Riddet Institute scientist

Riddet Institute scientist Dr Nick Smith has been selected for the International Science Council Global Roster of Experts, chosen from over 1,000 applicants globally. This recognition highlights his expertise in addressing critical global challenges, including climate change and health crises.

→ Engaging more minds in food science

The Riddet Institute's LinkedIn community continues to grow

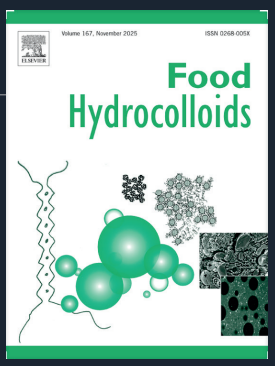
6400

and counting!

→ Academic publishing tally

233 journal articles

2 book chapters were published in 2024.



STRATEGIC

1 GLOBAL SCIENCE EXCELLENCE:

Aotearoa New Zealand is recognised for its world-class expertise in food science and related disciplines

232 journal articles published.

1 book chapter published.

4 lectures from visiting scientists.

15 overseas interns/PhD students.

1 international conference hosted by the Riddet Institute.

Riddet Institute scientists presented at

33 international conferences.

2 major (>$10M) collaborative research programmes established.

$4m awarded towards internationally funded projects.

2 INNOVATION & CAPABILITY BUILDING:

A world-leading, innovative and sustainable food sector in Aotearoa New Zealand.

14 undergraduate students interned at the institute over the summer.

15 postgraduate students recruited.

10 postgraduate students completed their studies.

5 new graduates entered roles in New Zealand science or industry.

1.8m received from NZ industry in 2024.

13 key industry strategic partners continue to work with the Riddet Institute on world-class research projects.

4 new innovations are in the process of being commercialised.

3 INDUSTRY LEADERSHIP

A future-proofed and future-focused food sector in Aotearoa New Zealand that addresses local and global sustainability challenges.

Riddet Institute researchers appeared in

21 radio, television or podcast interviews.

190 news media articles featuring Riddet Institute research/ expertise were published.

An academic article about the global food trade was republished a further

15 times in a range of national and international titles.

Riddet Institute involvement and leadership provided for

3 industry events, and gave presentations at an additional

3 dairy industry meetings.

The Sustainable Nutrition Initiative® (SNi) has continued to expand its influence both nationally and internationally, and has informed government policy on future-proofing the New Zealand agri-food sector.

Riddet Institute researchers were involved in

10 public outreach events addressing food systems and sustainability, nutrition or climate change.

4

MĀORI PARTNERSHIPS:

A stronger indigenous food sector in Aotearoa New Zealand, supporting improved outcomes for Māori.

To facilitate innovation, we have continued to extend our reach within the Māori agri-food sector, and to add breadth and depth to our relationships with Māori organisations, hapū and iwi.

The Riddet Institute's Sustainable Nutrition Initiative® and Riddet strategic partner Wakatū Incorporation have appointed projecta personnel throughout 2024, after securing more than

$10m

in funding from MBIE for a collaborative Endeavour Fund project "Kai anamata mō Aotearoa – exploring future food system scenarios and impacts".

5

Pūhoro STEMM Academy students interned with the institute to work on summer projects in line with their aspirations and relevant to Māori-led business entities.

Several projects, ranging from combining maturanga with modern science, to exploring whenua and resources to produce high value crops, have commenced.

5

EQUITY AND INCLUSION:

The food sector in Aotearoa New Zealand is more inclusive, diverse, and equitable, and provides more opportunities for Māori and Pacific people.

60% of our current postgraduate students and emerging scientists and

51% of our staff are women.

3 Māori postgraduate students.

3 Pacific postgraduate students.

8 Māori and

1 Pacific undergraduate students interned over the summer.

6

INFORMING CONSUMER CHOICE:

New nutritional indices of food and nutritional guidelines that provide more informed food choices for consumers.

A special edition of the prestigious *Frontiers in Nutrition* journal was published in 2024 focusing on research presented at the Dietary Protein for Human Health Symposium in Utrecht in 2023, co-organised by the Riddet Institute.

Dist. Prof Paul Moughan has had long-standing roles in several groups contributing to food policy and guidelines, and in 2024 also acted as Advisor to the Gates Foundation, The United States Agency for International Development (USAID), and the United States National Academy of Sciences (NAS) in the areas of nutrition and food security.

Prof Warren McNabb was appointed to the WHO Risk-Benefit Assessment Technical Group (RBAG) for the upcoming Food-Based Dietary Guidelines (June 2024).

Dr Suzanne Hodgkinson was invited to join the FAO/IAEA Protein Quality Database Technical Advisory Group. This is an appointment to a new scientific group convoked by the United Nations FAO and International Atomic Energy Agency (IAEA) for a two-year period.

IMPACT

JANUARY DECEMBER 2024

Aotearoa New Zealand is recognised for its world-class expertise in food science and related disciplines, enhancing its reputation as a trustworthy producer of high-quality food, and catalysing investment in food innovation and international collaborations in food research.

RESEARCH PROGRAMME LOOKS TO A HEALTHY FUTURE FOR HUMANITY

RESEARCH PLAN FOR CORE 2021 - 2028

The Riddet Institute intends to generate the future knowledge and skills required to help address the unprecedented challenges and disruptions facing the food sector in a rapidly changing world. It aims to be the world's top institute in discovery-led research at the frontier of food materials science, nutrition and health, and will develop high calibre human capital to ensure rapid innovation, a vibrant food sector and long-lasting socioeconomic benefits for New Zealand.

The food sector is undergoing a significant transformation, with the need for more food, healthier food, less food wastage and sustainable low emission, resource-efficient production. This constitutes a complex challenge, providing both opportunities and risks for New Zealand's food-export-led economy.

The Riddet Institute's contribution to this challenge is well recognised – it is internationally regarded as a leading centre of research and scholarship at the interface of food science and nutrition. It has undertaken ground-breaking, discovery-based research into the science of food structures and their complex interactions with nutrient absorption, metabolism and human health and wellbeing. It is an innovation engine for the New Zealand food industry.

The next generation of food products will need to address not only nutrition and health, but also the most pressing environmental and ethical issues of our time. Foods need to become more sustainable: environmentally, nutritionally, socially, and economically. This will require the introduction of new materials in the food chain, as well as the creation of foods that appeal to consumers and deliver their nutritional needs with less wastage. This could include novel crops, animal protein replacers, marine plants, and food materials from bioreactors.

The Riddet Institute CoRE research programme comprises three interlinked research themes and two overarching supporting elements.

Each theme has several tightly connected projects that are generating new knowledge in defined areas. Investigators work across themes and projects to collectively contribute to the overall vision of:

"Future Foods in Harmony with Nature".

The vision of the Riddet Institute Centre of Research Excellence (CoRE) research programme is:

FUTURE FOODS IN HARMONY WITH NATURE

This vision provides the fundamental underpinning science to support tomorrow's innovations in advanced foods. These foods will be sustainable, support optimal nutrition, human health and wellbeing, and appeal to the preferences of tomorrow's global consumers.

RESEARCH THEMES AND SUPPORTING ELEMENTS

THEMES

01: THEME

FOOD STRUCTURE DESIGN AND NUTRIENT DELIVERY

THEME OVERVIEW //

This research theme addresses one of the most important scientific challenges for optimising the nutritional value of sustainable foods, by unpacking the hierarchy of complex structures occurring in foods and their modifications during processing and gastrointestinal digestion. Crucially, this theme will integrate advanced computational and mathematical modelling and human clinical studies with food structure and digestion science to provide advanced knowledge to completely transform current food design processes and food dietary guidelines. There are three research projects under this theme.

02: THEME

FUTURE PROTEINS

THEME OVERVIEW //

This research theme addresses the challenges of transitioning from animal proteins to more sustainable plant and other alternative proteins, driven by consumer perceptions around nutrition, health, animal welfare, and the sustainability of food production. This transition can take place either by turning plant proteins into food products that mimic animal product functionality and nutritional quality or by consuming foods that contain some animal protein but proportionately more plant protein. This theme will provide underpinning knowledge that will allow the development of innovative sustainable protein ingredients and food products and will provide opportunities for new market development. There are two research projects under this theme.

03: THEME

TRANSFORMATIONAL TECHNOLOGIES

THEME OVERVIEW //

The intersections of food, biotechnology, digital technologies, and robotics are beginning to disrupt and transform the global food industry. New and emerging technologies are being harnessed to design new ways to produce and consume food, responding to both consumer trends and an imperative to improve sustainability and human health. Many of the innovations are based on the use of synthetic biology and bioengineering approaches to produce animal protein foods in non-traditional ways, leading to the emergence of synthetic, cultured, and engineered foods. There are three research projects under this theme.

COMPLEX SYSTEMS SCIENCE //

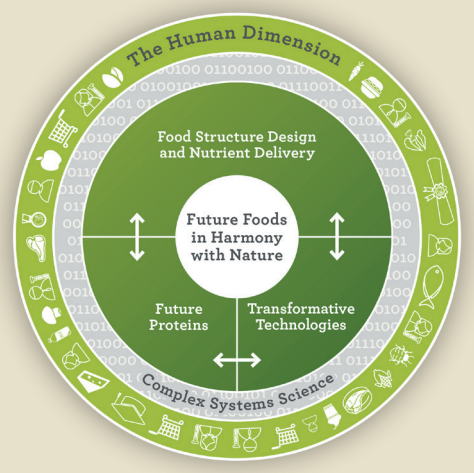
Complex systems exhibit attributes that are irreducible to the properties of individual elements of that system, such that the complexity of such systems can be fully understood only by studying the system in its entirety. Food, and its behaviour during digestion, is inherently complex and challenging to study and model. However, the increasing availability of large, complex datasets, and advances in machine learning and artificial intelligence, open possibilities for studying this complexity. The Institute is using Artificial Intelligence (AI) and Machine Learning (ML) to analyse complex food system data, design robust experiments, and model system behaviours. For instance, AI is being utilised to classify food products based on their behaviour during digestion through project 1.2 (on page 22), offering new insights into food properties and nutrient uptake.

THE HUMAN DIMENSION //

The Human Dimension elements recognises the importance of understanding the broader social and cultural contexts in which food systems operate. This includes examining how societal factors influence food choices and the role of food science in shaping health outcomes. The three projects in this domain explore Māori food knowledge and its impact on well-being, consumer acceptance and sensory properties of sustainable future foods, and the effects of food structure and diets on long-term health outcomes.

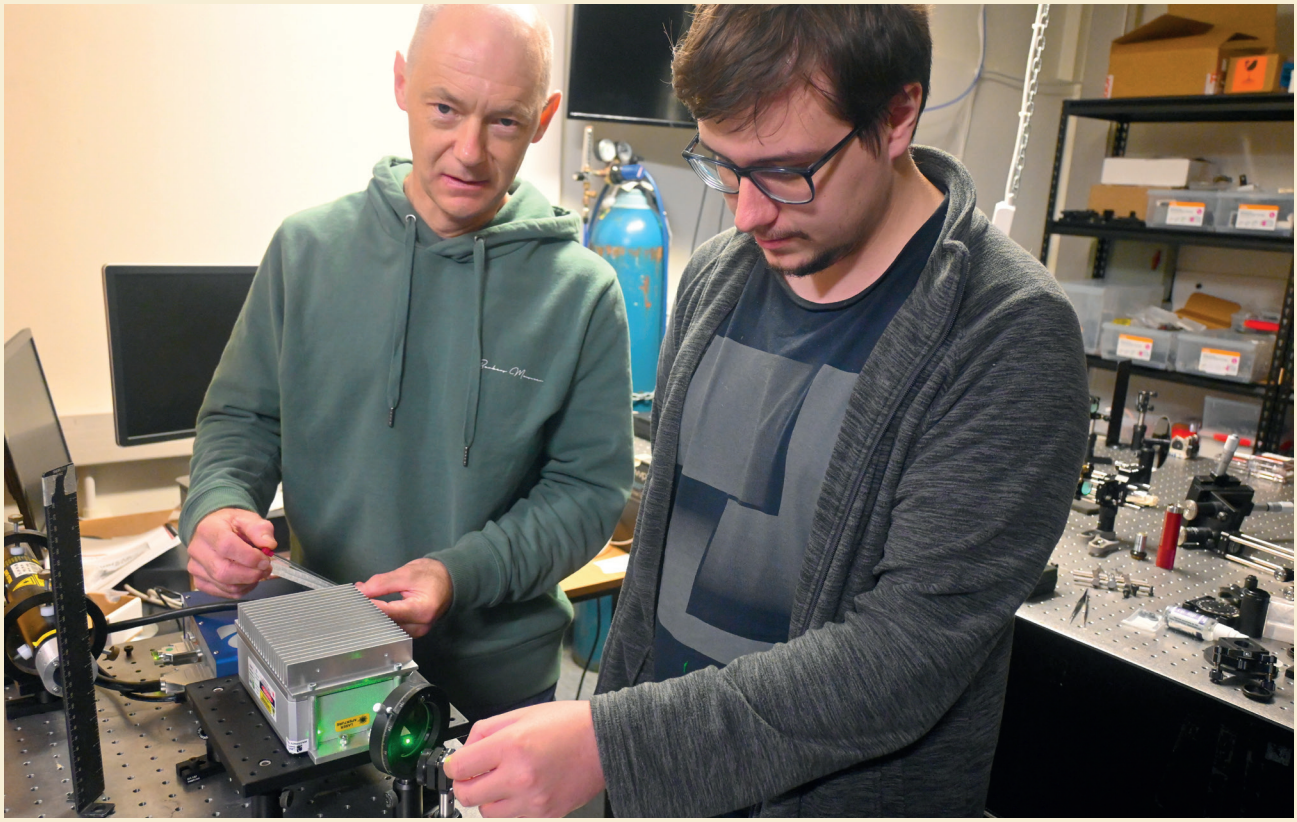
TRANSDISCIPLINARY RESEARCH (TDR) //

By crossing traditional disciplinary boundaries, Riddet Institute researchers are tackling real-world challenges with collaborative, outcome-driven projects. One such project focuses on enhancing the nutrition of the elderly through engineered food structures that optimise texture, nutrient delivery, and bioavailability, addressing the difficulties faced by the elderly in maintaining a balanced diet due to sensory and digestive challenges.



Future foods in harmony with nature

Pictured is the representation of our three research themes, with two overarching supporting elements. All elements are targeted at the central mission of Future Foods in Harmony with Nature.



Prof Mark Waterland and PhD student Andre Buzas Stowers-Hull adjust the confocal Raman microscope used for analysing food structure.

THEME 01:

MERGING DISCIPLINES ADVANCES FOOD SCIENCE

PROJECT 1.1
FOOD STRUCTURE DESIGN FOR OPTIMAL NUTRIENT DELIVERY

Understanding the structures in food is considered key to formulating new foods offering better nutrition.

Foods are complex in nature and contain hierarchical structures ranging from the nanometric to the micrometric scale. This spatial arrangement in foods is diverse and changes with composition, processing and cooking.

This project seeks to understand those complex structures and to unravel the dynamic processes involved in the assembly and disassembly of food structures during digestion, an understanding that is fundamental to how nutrients are released and absorbed in the gastrointestinal tract.

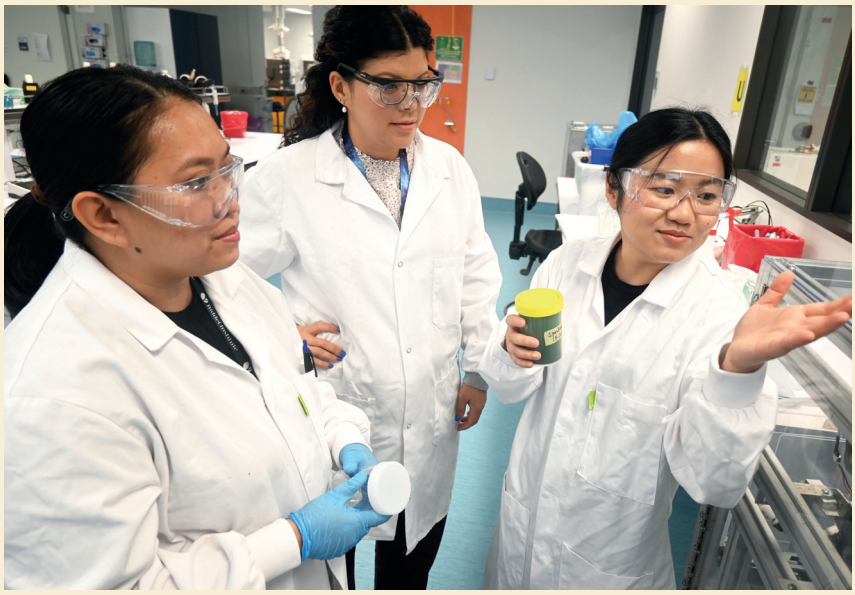
Led by Dr Alejandra Acevedo-Fani, Prof Mark Waterland and Dist. Prof Harjinder Singh, the project bridges a knowledge gap by merging scientific disciplines and integrating advanced analytical tools, together with dynamic in vitro and in vivo models to simulate human digestion.

One key area of research has been focused on finding novel ways to improve the functionality of foods. Our PhD students are exploring techniques to modify existing foods for enhanced health outcomes, or to understand interactions between food components so new hybrid foods can be developed. Students are investigating the effects of combining plant and dairy proteins, finding ways to fortify plant foods with useful amino acids, or learning the secrets of milk fat globules and how they can protect the gut from harmful bacteria. Other students are assessing the effect of new food processing techniques and developing protocols for substituting less desirable food components like dietary cholesterol with plant sterols.

In these studies, we use advanced characterisation techniques such as Raman Spectroscopy, Small Angle X-ray and Neutron Scattering to study such complex new foods in-depth.

We have also made significant progress in the field of digestion by providing robust evidence on how the physical structure of foods influences the rate at which nutrients are broken down and released in the gastrointestinal tract. We use dynamic in vitro digestion models, developed in the previous CoRE programme, which aim to mimic the physical and biochemical conditions of the gastrointestinal environment and rigorously correlate this in vitro data with in vivo data from digestion studies in both human and animal models.

Our previous work highlighted how modifying the state and structures of individual foods will affect the kinetics of the release of nutrients,



From left: PhD student Crisline Alhambra, project lead Dr Alejandra Acevedo-Fani, and Postdoctoral Fellow Dr Xinya Wang with a spirulina and semolina sample 'digested' by the Human Gastric Simulator machine, right, in the Riddet Institute laboratory space.

Some of the samples used in the digestion study, from left, spirulina and semolina, halloumi and pasta, and spirulina with pasta.

gastric emptying and the subsequent digestion of foods in the small intestine. To advance our understanding, we need to explore further digestion kinetics and interactions when multiple foods are combined.

To this end, PhD student Crisline Alhambra has commenced an in vivo study to investigate the behaviour of food combinations consisting of a carbohydrate-based and protein-based food. The two carbohydrate sources are semolina and pasta. Based on the data from our prior studies, these wheat-based foods with different structures and breakdown rates have the same (~100%) starch digestibility.

Two protein sources were selected with contrasting digestibility and different structures: halloumi (cheese) and spirulina. Halloumi has an intact physical structure that is slow to break down, but high protein digestibility, while spirulina requires limited structural breakdown, but has lower protein digestibility.

These foods were consumed in four combinations (halloumi – pasta; halloumi – semolina; spirulina – pasta; spirulina – semolina). One important finding was that meals with both carbohydrates and proteins caused the stomach to acidify more slowly compared to meals that were rich in carbohydrates only.

These differences are significant for digestion because they can influence the time it takes for food to be digested and emptied from the stomach, which in turn affects nutrient absorption. In the next stage, these in vivo data will be correlated with in vitro digestion data obtained from our dynamic digestion models using the same food combinations.

This is a good example of how combining in vivo knowledge with in vitro data allows us to better understand the impact of structures on the release kinetics and uptake of nutrients. This integrated approach will enable us to develop additional quantitative relationships that guide the design of food structures to enhance nutrient absorption.

Another key area of research is the role that food structure plays in micronutrient delivery. With the rise of new food sources, questions are raised as to how efficiently we can absorb micronutrients from these foods and whether this could be a cause for nutritional deficiency in the future. Postdoctoral Fellow Dr Xinya Wang is working on establishing robust methodologies to link the relationship between the physical properties of protein-rich foods made from plant, dairy and plant/dairy protein combinations with the release rate and bioaccessibility of micronutrients.

In a recent study, we demonstrated that varying the physical structure of whey protein gels fortified with calcium (liquid, soft and hard gel) led to significant changes in the kinetics of calcium release under in vitro digestion conditions. We found that gelled whey protein releases calcium more slowly than liquid whey protein, even though both contain the same amount of calcium. This slower release happens because the calcium is trapped in the gel structure, which breaks down gradually. This pattern continues in the intestine, showing how important the stomach is in releasing minerals from food. These results suggest that changing the structure of food can help control how calcium is released, potentially optimising absorption.

The team has also been exploring the use of functional magnetic resonance imaging (MRI) to visualise food structures in humans and monitor gastric digestion of different food matrices.

THEME 01:

SCIENTISTS SERVING UP COMPLETE DIGESTION SIMULATOR

PROJECT 1.2
THE HUMAN DIGESTOME

What if we could simulate every stage of digestion, from food breakdown to nutrient absorption, without relying on human or animal trials? This is the vision behind the Human Digestome – a project led by Prof Leo Cheng and Prof Gail Bornhorst, alongside researchers including Marco Morgenstern, Prof Peter Xu, Dr Esther Kim, and Dr Nadun Palmada.

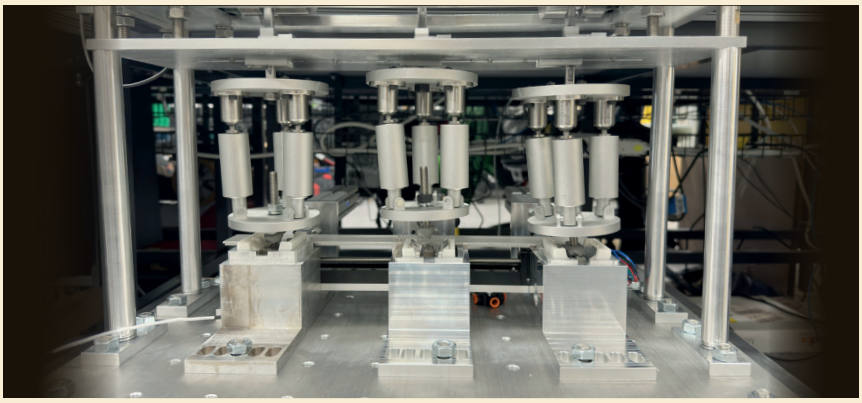
The Riddet Institute has already made important progress in understanding digestion, examining how food changes during chewing, how the stomach and intestines move, and how certain types of food break down in the human gastrointestinal tract (GIT). Despite this progress, these components remain relatively discrete models or systems.

Project 1.2 aims to create integrated, realistic models of the GIT, where physical and computational models work together to mimic how food is broken down in the various stages of the GIT and absorbed as nutrients.

The mashing, grinding, and mixing in the mouth, the churning of the stomach, and the absorption of nutrients in the small intestine are all part of a complex digestive process. The Human Digestome will model the digestive process using two complementary models: physical simulators that mimic the mouth, stomach and small intestine, and computational models that digitally represent gastrointestinal motility and food breakdown. Both physical and computational models are refined using data from in vivo studies (such as those carried out in Project 1.1).

Progress has been made toward developing integrated physical and computational digestive models. A next-generation chewing robot, TriChewer, was developed as a physical simulator, to incorporate three oral chambers that allow multiple food samples to be chewed at the same time. The robot can automatically add food, collect chewed samples, and introduce saliva, while also sensing and controlling these actions.

Researchers are also working on enhancing existing physical gastric and intestinal models by improving methods of gastric fluid secretion, stomach emptying and nutrient absorption in the small intestine.



The TriChewer, a mechanical chewing model.

METABOLIC STUDIES ENTER A NEW PHASE

PROJECT 1.3
FOOD STRUCTURES AND METABOLISM

The focus of this project is the health consequences of complex food interactions, particularly the physiological and metabolic outcomes and how these are influenced by food structure.

In the project led by Prof Nicole Roy, Assoc Prof Jennifer Miles-Chan and Prof Warren McNabb, the modification of foods and nutrient structures is expected to have an impact on digestion, absorption of nutrients and physiological responses.

Research has centred on the effects of hydrolysis of dairy proteins on postprandial metabolism, the parameters of microbiome-mediated appetite control, and the impact of various foods on gastrointestinal physiology and function. Studies involving human participants have been completed to investigate how the sustained consumption of bovine, ovine or caprine milk affects digestive and metabolic health and nutritional status, primarily funded by the High-Value Nutrition National Science Challenge and industry partners.

In association with Project 1.1, the team is currently preparing to conduct a food intervention study, with human participants, using novel methods to assess gastric physiology and energy metabolism, alongside magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) to investigate gastric emptying and brain responses.

Another research stream involves investigation into novel indices or markers of health and nutrition. This has included the development of a mass-spectrometry-based method to rapidly measure multiple metabolite markers of dietary intakes.

Prof Indrawati Oey with the bespoke pulsed electric field equipment during a workshop.

THEME 02:

NOVEL TECHNOLOGY OPENS NEW FOOD FRONTIERS

PROJECT 2.1
NOVEL PROCESSING TO ENHANCE PLANT PROTEIN FUNCTIONALITY AND UTILISATION

This project builds on previous work investigating the potential of using emerging food processing technologies to modify protein structures in plant foods for improved functionality.

In a project led by Prof Indrawati Oey and Dr Kevin Sutton, the team has been using plant protein sources that are of interest to future New Zealand agricultural systems, such as linseed, peas and oats (while also keeping an eye on other emerging crops such as quinoa, hemp, tree nuts and algae).

Despite growing consumer demand and the rising availability of plant protein ingredients and foods, existing plant-based protein products rarely compare well with animal proteins for consumer-facing characteristics, such as appearance, taste or texture. The techno-functional and nutritional potential of plant-based foods is also important, although often limited.

In this project, the researchers have made significant progress in determining how to alter the functionality of plant-based proteins using food processing technologies, such as pulsed electric field (PEF), fermentation, germination, and high-pressure homogenisation (HPH), while also determining the effects on sensory properties and digestion.

Recent research has employed Pulsed Electric Fields (PEF) as a non-thermal pasteurisation technique. PEF can be used in conjunction with various lactic acid bacterial strains to create gelled structures during the fermentation of selected plant protein sources, specifically oat and pea. This research, led by PhD student Nicholas Horlacher, was presented in two conferences in Rome and Rimini, Italy, in 2024. The technique is now being extended to include germinated oats, by PhD student Norma Cecille Bagarinao.

Robust and non-invasive spectroscopic techniques have been developed to assess the changes in the protein structure of unpurified plant protein isolates caused by using different extraction methods, including PEF pretreatment. In addition, 3-D printing extrusion technology and other techniques have been used to create specific food structures with sensory appeal for solid foods with a high plant protein content.

Despite this progress, there are still untapped opportunities to investigate integrated or combinatorial processing techniques (such as PEF + fermentation) to develop unique protein functionalities in plant-based foods.

The goal is to move away from an approach using purified protein ingredients to make foods, toward one where protein-rich, semi-refined plant materials are used, with their anti-nutritional components removed or deactivated. This way significant proportions of the physical and chemical structure of the natural raw materials are retained, creating high-quality, healthier food products, with more fibre and micronutrients. Embracing the use of these novel technologies is also expected to lower energy and water use, and generate less waste.

THEME 02:

COMBINED ANIMAL AND PLANT PROTEIN FOODS TO BE FORMED

PROJECT 2.2
UNDERSTANDING THE FUNCTIONALITY AND NUTRITIONAL IMPACT OF COMPOSITE PROTEINS

This project seeks to create entirely new food products with optimal nutritional and functional properties by combining the best attributes of animal-based proteins and plant or algal proteins and processing them in unique ways.

Plant proteins on their own often have a sub-optimal essential amino acid pattern and lack some of the micro-elements and vitamins of animal-derived foods. But plant foods do contain some beneficial compounds lacking in animal-based foods, such as vitamin C, vitamin E, fibre and polyphenolics which act as antioxidants.

Led by Dist. Prof Paul Moughan and Prof Aiqian Ye, Project 2.2 aims to bring together the best attributes of both plant- and animal-based foods, and to benefit from the synergistic interactions that are present, to achieve optimal nutrient delivery and enhanced functionality.

This will result in a new range of environmentally sustainable 'combinatorial' protein ingredients and proteinaceous foods addressing specific physiological endpoints.

A unique aspect of this project is that the true bioavailability of protein and amino acids is considered in preparing new formulations.

As the digestibility and availability of amino acids in foods is highly variable, a protein digestibility database has been built. A similar database on the physico-chemical properties of a wide range of plant proteins is under development.

The mathematical technique of Linear Programming is applied to predict food compositions that maximise or minimise certain functional or nutritional attributes. The algorithm has been applied to solve complex formulation problems and to apply a deep understanding of the properties and chemistry of food.

TECHNOLOGY ENABLES PRECISE ENGINEERING AND PROTEIN EDITING

Hemp seed oils are being used in protein research.

PROJECT 3.2
RECOMBINANT TECHNOLOGY FOR FOOD PROTEIN PRODUCTION

Emerging recombinant technologies and protein engineering are showing promise in the production of new proteins.

Since ancient times microorganisms have been used to make food and beverages, such as bread, cheeses, wine or beer. Project 3.2, led by Professors Emily Parker, Renwick Dobson and Geoff Jameson, takes this concept into the modern era using technology to precisely alter microorganisms for specific outcomes.

Project 3.2 is about developing innovative methods to produce new food proteins, or editing current proteins, such as the possibility of altering the sequences in milk that cause allergies.

The team has successfully expressed and purified proteins from seed oil bodies known as oleosins in bacteria and plants. Multiple proteins are also expected to arise from using unicellular fungal yeast systems and bacteria; and, in separate research, with fresh-water and marine microalgae. Additional food protein research they are undertaking include engineering sweet brazzein plant proteins to increase their stability during food processing, and designing allergy-free variants of the whey protein beta-lactoglobulin.

Work done on the previous 3.1 lab-grown meat protein project has led to research on the enzyme Rubisco derived from spinach plants. This research is looking at Rubisco's suitability to make microcarriers for mammalian cell growth.

Professor Munish Puri with a bioreactor used in non-genetic methods to engineer food.

THEME 03:

NEW PROJECT TO BUILD CAPACITY IN BIOPROCESSING TECHNOLOGIES

PROJECT 3.3
PRECISION FERMENTATION FOR SUSTAINABLE PRODUCTION OF SMART FATS AND PROTEINS

The global food industry is being transformed. New and emerging technologies are being used to produce food, responding to both consumer trends and an imperative to improve sustainability and human health.

In this project, led by Prof Munish Puri, new technologies using cell-based methods for producing food will be advanced.

Biotechnology, digital technologies, and robotics are increasingly playing a role in the food industry. Part of this disruption has seen a global rise in demand for alternative proteins, produced from non-animal products such as plant-based meats, proteins and fats.

In 2024 the Riddet Institute appointed Professor Munish Puri to a newly created role, the Chair in Alternative Proteins, established jointly with AgResearch. The joint-professorship aims to strengthen New Zealand's capability in the fast-growing cultivated food industry.

The aim of Project 3.3 is to develop and exploit microbial bioprocessing methods to produce animal-free proteins, smart fats and flavours, a technology that Prof Puri specialises in.

Precision fermentation is a promising way to sustainably produce high-value food/speciality ingredients such as proteins, fats, flavours, pigments and vitamins.

Project 3.3 involves leveraging evolved or engineered microorganisms through precision fermentation and using non-genetic approaches to manipulate microbes to create novel high-value ingredients for food and nutraceutical applications.

Among the initial objectives of this new project are the development of in-house microbial cultures, such as yeasts, fungi, microalgae and bacteria, for use in creating high-value proteins, fats and functional ingredients. The project team will also be optimising fermentation and process conditions, and developing cost-effective methods.

Later, the project will turn towards the scale up and economic feasibility of production and subsequent development of innovative foods, such as protein-enriched beverages, dairy alternatives and meat analogues.

The project outcomes will assist the New Zealand food industry to deliver a safe, sustainable, and financially viable supply of food ingredients for the global health food market, a market that is expanding rapidly. It is anticipated that the global precision fermentation food market will reach NZ $35B by 2031. This project is considered key to Aotearoa New Zealand's participation in a growing field and building capacity to capitalise on future opportunities to meet consumer demands and explore new export markets. The work ties in with Project 3.2 by supplying novel new ingredients to extend New Zealand's conventional food production with new combinatorial foods.

STUDENT DISCOVERIES

01: Salanieta Naliva

Determinants of Nutrition and Health Risks in Older Adults in Fiji

As the ageing population continues to grow, PhD student Salanieta Naliva is investigating the nutritional challenges faced by older adults in Fiji. The research aims to assess the nutrition status of individuals aged 55 and above in the Central Division of Fiji, while also considering socio-economic, cultural, and environmental factors. Through a series of studies, Salanieta is working to design cost-effective interventions to improve nutrition and promote healthy eating in older Fijians.

Preliminary findings indicate a significant proportion of the population is at risk of malnutrition, with key factors including ethnicity, living conditions, and coexisting health conditions. By understanding these factors, this research hopes to improve the knowledge and practices of healthcare professionals and caregivers, ultimately contributing to healthier ageing in Fiji. The findings are expected to inform policy decisions and community health strategies, leading to improved nutritional outcomes for older adults in Fiji.

02: Ai Ting Goh

Effects of feeding practices and parental diets on children's acceptance to novel plant-based meat alternatives (PBMA)

With the increasing global demand for sustainable food sources, PhD student Ai Ting Goh is researching how plant-based meat alternatives (PBMAs) can be integrated into family diets.

Focusing on the impact of parental feeding practices and children's eating behaviours, Ai Ting Goh aims to foster habitual consumption of PBMAs by improving knowledge and familiarity within family meal settings.

Preliminary findings suggest that regular exposure to PBMAs increases positive attitudes towards these alternatives, especially among frequent users. By examining factors such as parental influence, taste sensitivity, and meal context, this research seeks to promote healthier, more sustainable eating habits that could reduce reliance on meat. The findings aim to assist families, food manufacturers, and policymakers in encouraging long-term adoption of PBMAs for a sustainable food future.

03: Di Lu

Macrostructural design rules and requirements for plant protein-based food products

Plant-based cheese alternatives are becoming increasingly popular among consumers seeking animal-free options. However, plant proteins naturally lack the structural properties of casein, the protein responsible for the melt, stretch, and texture in traditional dairy cheese. PhD student Di Lu is addressing this challenge through innovative research.

By experimenting with different plant proteins, such as mung bean and hemp protein, Di Lu is developing hybrid cheeses that combine plant-based and casein proteins. These hybrid cheeses are studied to understand how plant proteins interact with casein and fat, as well as how hybridization affects the functionality and texture of cheese. Further studies will explore techniques like enzymatic hydrolysis to modify and enhance the texture, meltability, and stretchability of the plant protein-based cheeses, aiming to closely mimic the properties of casein.

Di Lu is also studying the food's microstructure using advanced techniques like Confocal Microscopy and FTIR spectroscopy. This research aims to uncover how plant proteins interact at the molecular level and how modifications can improve functionality. Ultimately, the goal is to create plant-based cheeses that meet consumer expectations for taste, texture, and performance, providing a high-quality, sustainable alternative to traditional dairy products.

04: Vitor Geniselli Da Silva

Foods to optimise the colonic microbiome for our lifelong health and wellbeing

As gut health research gains momentum, PhD student Vitor Geniselli Da Silva is exploring how diet influences the development of the gut microbiota in infants during the transition to solid foods. By combining computational models with *in vitro* digestion and faecal fermentation techniques, the research aims to identify foods that support beneficial gut bacteria during the weaning period.

Preliminary findings suggest that berries, such as blackcurrants and raspberries, may play a role in fostering a healthier gut microbiota in New Zealand infants. However, there are still obstacles to overcome, including the highly personalised nature of gut microbes and ethical considerations in obtaining samples.

This research has the potential to refine dietary recommendations for infants, paving the way for future clinical trials. By integrating modelling approaches into microbiota studies, it hopes to accelerate discoveries in gut health and contribute to lifelong well-being through early-life nutrition.

05: Jervee Punzalan

From structure to functionality: Investigating molecular-level properties of semi-refined plant protein extract

PhD student Jervee Punzalan is exploring eco-friendly methods for extracting and characterising plant proteins. Her research, From Structure to Functionality: Investigating Molecular-Level Properties of Semi-Refined Plant Protein Extracts, utilises pulsed electric field (PEF) technology along with vibrational spectroscopy and chemometric analysis to develop rapid, non-destructive protein assessment techniques. This work aims to tackle challenges in plant protein extraction, such as inefficient interaction mapping and the need for optimised extraction conditions.

By using near-infrared (NIR), Raman, and mid-infrared spectroscopy, Jervee seeks to refine protein analysis while minimising environmental impact. Early findings suggest that MicroNIR spectroscopy, combined with chemometrics, can accurately assess protein content in flaxseed extracts, while Raman spectroscopy differentiates proteins from various extraction methods. However, challenges like spectral interference and limited reference data remain.

This research benefits food manufacturers, agricultural producers, and policymakers by supporting sustainable food production and advancing plant-based food innovation.

06: Isurie Akarawita

A deep learning model for real-time assessment and prediction of *in vitro* chewing

PhD student Isurie Akarawita is developing a deep learning model for real-time *in vitro* chewing analysis. Traditional methods for assessing *in vitro* chewing are slow, labour-intensive, and lack real-time evaluation. This research aims to automate the evaluation of food texture and predict when food reaches a swallowable consistency. By using machine vision and deep learning, the model analyses data from robotic chewing experiments, focusing on both beef and plant-based burger patties.

Preliminary findings show the potential for image analysis techniques to assess the dynamics of food bolus formation during robotic *in vitro* chewing. The goal is to revolutionise how food behaviour is studied and ensure safer, more efficient food production that satisfies the expectations of consumers. This work will inspire industry leaders and researchers to adopt cutting-edge technologies for better food design and consumer health.

Future-proofing the Aotearoa New Zealand food sector:
developing capability, creating, and transferring knowledge and addressing local and global sustainability challenges.

From left: Miriana Stephens, Prof Warren McNabb, Prof Charles Eason; Dr Nick Smith, Dr Conal Smith

KAMA SHAPES AOTEAROA'S PATH TO A SUSTAINABLE FOOD FUTURE

Creating a sustainable future for Aotearoa's food system starts with collaboration and innovative thinking, and the Riddet Institute's Sustainable Nutrition Initiative® (SNi®) is at the forefront.

A five-year, $10 million MBIE-funded programme, 'Kai anamata mō Aotearoa' or KAMA, has a shared vision to build a sustainable and resilient food system that supports economic, environmental, social, and cultural well-being.

The programme is co-led by the Riddet Institute and the hapū entity Wakatū Incorporation. The programme's modelling team, which also includes researchers from Fonterra, AgResearch, University of Canterbury, and Lincoln University, aims to offer practical solutions for a more sustainable food sector.

One of the key milestones in this journey was the regional food system wānanga held in October at Te Āwhina Marae in Motueka, hosted by Miriana Stephens, General Manager at AuOra, the mātauranga Māori, research and innovation group of Wakatū. This wānanga marked the launch of the first phase of developing a regional food strategy for Te Tauihu (top of the South Island), a critical component of the KAMA programme. Attendees engaged in discussions on the value of indigenous crops, food security, and pathway to sustainable land use. The event highlighted the importance of grounding strategies in the strengths and wisdom of the whenua and the people of Te Tauihu.

"We are building an interactive model to steer the food sector towards a carbon-neutral future, grounded in real-world data from Te Tauihu," explains Dr Nick Smith, Research Officer in the Institute's SNi® team.

The programme will further explore commercial uses of indigenous crops in Te Tauihu. Charles Eason, Pou Whakahaere Pūtaiao at Wakatū and Professor at Lincoln University, is supporting the team along with Professor Nick Roskruge with horticultural and practical expertise. Prof Eason and Dr Smith lead the on-the-ground data collection, testing both new and existing indigenous crops for their scalability in a culturally respectful way.

These data collection and evaluation efforts aim to address current knowledge gaps in wellbeing and improve land management practices at both enterprise and farm levels. Dr Conal Smith, a Wellington-based economist, will provide crucial insights by linking this work to the World Wellbeing Panel.

"Our model will help stakeholders and policymakers strengthen Aotearoa's food system against disruptions like climate change and export restrictions, while addressing health and food accessibility issues," adds Dr Smith. "It will also reveal the broader impacts of land use, trade, and overall well-being."

ADVANCING CROSS-CULTURAL SENSORY RESEARCH AT EUROSENSE 2024

Professor Joanne Hort spoke on the importance of considering cultural differences when undertaking consumer and sensory food science research.

Fonterra Riddet Chair in Consumer and Sensory Science at Massey University, Professor Joanne Hort engaged in an international audience as a keynote speaker at EuroSense 2024, held in Dublin.

Hosted by Sensory Food Network, Ireland, the 11th European Conference on Sensory and Consumer Research brought together over 750 delegates from around the globe.

The conference theme, 'A Sense of Global Culture,' provided an ideal setting for Professor Hort's keynote. She shared insights on how cultural differences shape perception, cognition, and food preferences.

"Culture influences not just how we think, but how we reason and perceive the world, especially in sensory research, where food preferences and perceptions vary significantly across regions," Prof Hort says.

A key takeaway from her address was the importance of fostering inclusivity in sensory research.

"Most methodologies originate in Western, Educated, Industrialised, Rich, and Democratic (WEIRD) nations," Prof Hort explained, "often rendering them less applicable to non-WEIRD populations."

Several Riddet Institute researchers and PhD students contributed to the conference. Riddet Institute researcher Dr Amanda Dupas de Matos presented her work on sensory differences between Chinese immigrants and local New Zealand consumers during a workshop on underrepresented populations. Her poster focused on the sensory characteristics of plant-based milk alternatives.

PhD student Summer Wright's poster examined perceptions of Māori food branding, as part of her thesis on Māori future foods. Another PhD student Yunfan Mo contributed two posters – one comparing sensory perceptions between plant-based and omnivorous dieters and another introducing an index to measure plant-based dietary habits.

Prof Hort noted EuroSense 2024 showcased a promising shift in sensory science, emphasising cultural inclusivity and innovation.

"Engaging with global experts and exploring new approaches was a highlight, reflecting the evolving landscape of sensory research."

INTERNATIONAL SCIENCE EXCELLENCE

RESEARCH COLLABORATION AND CONSORTIA

The Riddet Institute's investigators routinely collaborate with world-leading international research groups. The following ongoing collaborations provided additional capability and strength to the Institute's research programme:

*** International University Consortium of Food Science & Nutrition (IUCoFSN)**
This consortium is a formal research collaboration between the world-leading schools in food science including the University of Leeds (UK), Riddet Institute (Massey University, NZ), Wageningen University (the Netherlands), Zhejiang Gongshang University (China), Kyoto University (Japan), University of Guelph (Canada), and University of Massachusetts (USA).

*** PROTEOS Research Consortium**
Proteos is an international collaboration to characterise the nutritional quality of dietary food proteins based on the DIAAS methodology developed at the Riddet Institute. Results from Proteos were presented at the International Symposium on Dietary Protein for Human Health in 2023 (Utrecht, The Netherlands), hosted by the Riddet Institute with FAO and Wageningen UR. A special edition of Frontiers in Nutrition was published in 2024 based on topics presented at the symposium in collaboration with Wageningen UR, the top ranked university in the world in the field of agriculture (QS Rankings).

*** National Alternative Protein Innovation Centre (NAPIC)**
In 2024 the Riddet Institute was invited to join as a Research Partner of the National Alternative Protein Innovation Centre (NAPIC) based in the UK and co-led by Prof Anwesha Sarkar (University of Leeds) a Riddet Institute alumna.

*** New Zealand Singapore Future Foods Research Programme**
Riddet Institute investigators were involved in four collaborative projects exploring the potential for novel foods and food technologies, funded by the Ministry of Business, Innovation and Employment (MBIE) and the Agency for Science, Technology and Research (A*STAR) in Singapore.

*** INFOGEST**
This programme involves researchers from around the globe and seeks to provide a focal point for research and methodologies in digestion models.

*** CSIRO, Australia**
The Institute continues to collaborate with CSIRO in mounting the highly successful Food Structures Digestion and Health (FSDH) international conferences held alternately in New Zealand and Australia. The next FSDH conference will be held in Werribee, Australia in 2026.

*** INRAE & Institut Agro, France**
INRAE is France's national research institute for Agriculture, Food and Environment and has longstanding links with the Riddet Institute. In 2024 Drs Alejandra Acevedo-Fani, Suzanne Hodgkinson and Sylvia Chung Chun Lam were awarded an Erasmus mobility grant to enable further collaboration with Institut Agro, a university closely connected with INRAE.

More than 200 conference delegates on the Registry steps.

EXCELLENCE IN FOOD SCIENCE BRINGS THE WORLD TO HYDROCOLLOIDS CONFERENCE

Iwi representative Rawiri Shedlock blows a pūtatara (shell trumpet) as part of a traditional Māori welcoming ceremony for international delegates at the historic Refectory Building on the Massey University campus.

Leading scientists from around the world came to Palmerston North in November, thanks to the Riddet Institute's global reputation in food science.

Two hundred food scientists attended the 17th International Hydrocolloids Conference on November 12-15, hosted by the Riddet Institute, at Massey University in Palmerston North. Hydrocolloids are long-chain water-soluble molecules that form the building blocks for many food, nutraceuticals, and cosmetic products.

It was the first time the conference had been held in New Zealand in the 32-year history of the event, a fact Riddet Institute Director Distinguished Professor Harjinder Singh put down to New Zealand's world-class reputation in food science. He said hydrocolloids research had a vital role in preparing for a sustainable future, increasing food production, and improving nutrition in the human population.

The conference theme was Future Hydrocolloids for Sustainable Food and Living Solutions, and finding solutions to the world's problems was also the subject of Distinguished Professor Paul Moughan's opening address. He said mathematical modelling suggests 70 per cent more food would be needed to feed the growing global population by 2050.

"But not just more food, more nutrients. It has to be nutritionally adequate."

Today, close to one billion people were not getting adequate food, while ironically at the same time there was an "obesity epidemic," with too many people eating too much poor-quality food, he said. Both groups were malnourished and nutritionally deficient.

Dist. Prof Moughan said foods also contain beneficial bacteria, and fatty acids, among many other components not always considered in nutritional terms, but with profound effects on health and longevity. The combination of foods consumed could also produce synergies that went beyond what the elements could be expected to provide individually.

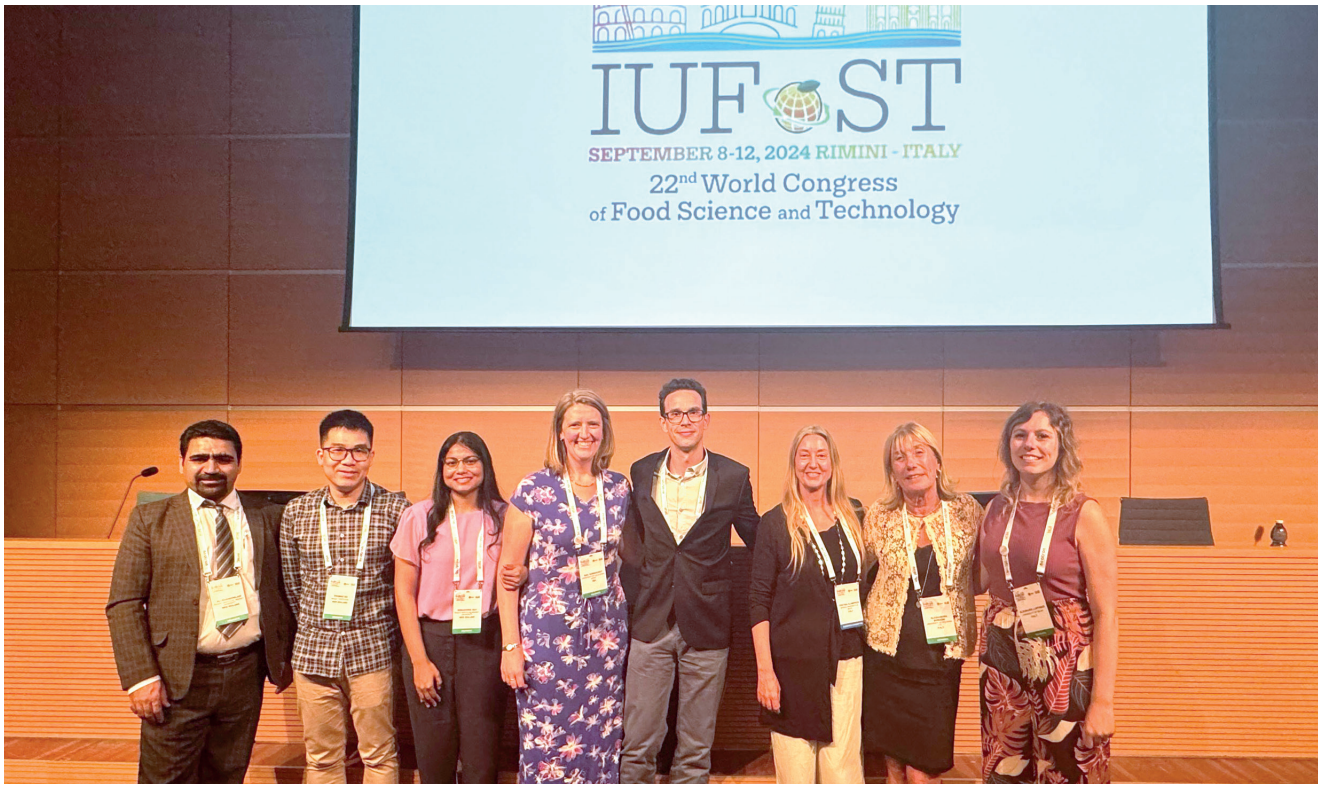
"Milk and cheese should be bad for you when you look at them nutritionally, but every study shows cheese and dairy products have great outcomes and health benefits, because of how the combination of things work."

This is why the study of hydrocolloids was so important. Understanding complex food structures could help find new ways to grow and supply nutritious food.

Several other Riddet Institute scientists also presented research at the conference, including Professor Aiqian Ye and Dr Alejandra Acevedo-Fani, who were both plenary speakers. About two thirds of the delegates came from overseas, including large contingents from Australia and China.

There were 100 presentations on the latest scientific thinking and research over the course of three days, with concurrent sessions occurring in three lecture theatres on Massey University's Turitea campus.

Many of the attendees also made the most of Massey University being located within a food hub of specialised food research organisations. While in Palmerston North, 40 conference delegates visited the Fonterra Research & Development Centre, situated close by, and attendees were also able to tour the food research facilities sited on the campus, including the Te Ohu Rangahau Kai laboratories, a collaboration between Massey University and AgResearch.



The Riddet Institute team presenting in Italy.

Researchers advance food science at IUFoST's World Congress in Italy

The 22nd IUFoST World Congress of Food Science and Technology brought together hundreds of food scientists, researchers, and industry leaders from around the world to explore the future of food. The event ran from September 8-12, 2024 in Rimini, Italy.

As part of the Congress, the Riddet Institute hosted a special session titled "Engineering Food Structures for Optimal Digestion and Nutrient Delivery," co-chaired by Professors Cristina Alamprese (University of Milan, Italy) and Gail Bornhorst (Principal Investigator, Riddet Institute). The session featured compelling presentations from international experts, offering the Riddet Institute a valuable opportunity to highlight its leadership in food science and technology.

This session underscored the Riddet Institute's contributions to advancing global understanding of food digestion and nutrient delivery and further cemented the Institute's position as a global leader in food science.

Riddet Institute Postdoctoral Fellow Dr Thomas Do also gave a plenary address at the Congress as part of the prestigious IUFoST Young Scientist Award for his research on the effects of heat treatment on the microstructure and hydrolysis of protein bodies from hempseeds.

The Riddet Institute's presence at IUFoST 2024 not only celebrated its ongoing scientific advancements but also demonstrated its commitment to addressing global food challenges through cutting-edge research and international collaboration.

Trail-blazing protein research leads to dedicated journal issue

Riddet Institute involvement in a successful international protein conference in 2023 has led to a special edition of the prestigious Frontiers in Nutrition journal.

Chaired by Riddet Institute Fellow Laureate Paul Moughan, the Dietary Protein for Human Health Symposium was held in Utrecht, in the Netherlands, in 2023 and was co-organised by the Food and Agricultural Organization of the United Nations (FAO), the Riddet Institute, Wageningen University and Research, and the International Atomic Energy Agency.

The special edition of Frontiers in Nutrition appeared in late 2024, drawing off the original research presented at the international symposium. Dist. Prof Moughan wrote in the open access issue's editorial that the collection of 25 scientific papers provided a comprehensive update of recent advances, and added to knowledge in a critical area.

"We need accurate information on how different foods and novel protein sources differ in their ability to provide the body with dietary essential amino acids. This has never been more important than now, with a significant global challenge to properly feed a growing human population within acceptable environmental boundaries."

The success of the Dietary Protein for Human Health Symposium in Utrecht has also led to a spin-off event being planned for 2025 as part of Nutrition 2025 conference in Orlando, United States.


frontiers | Frontiers in Nutrition

Editorial: Dietary protein for human health

SPOTLIGHT ON MĀORI AND PACIFIC

Summer Wright, left, with her Ansley Te Hiwi Student Communicator Award for 2024, is pictured with PhD student Salanieta Naliva at the Student Colloquium.

Presentation on perceptions of Māori food branding wins competition

PhD candidate Summer Wright (Ngāti Maniapoto) was our student communicator of 2024.

Her presentation about the differences between consumers from Singapore and Aotearoa wowed this year's judges of the Ansley Te Hiwi Student Communicator Award.

In an entertaining account of her interview techniques and findings Summer showcased her research into critical consumer perceptions of Māori food and beverage messaging, explaining that cultural and social contexts can make a big difference in how consumers perceive marketing on indigenous imagery and text on products.

The research examined how features like the use of te reo Māori and cultural elements resonate in both local and global markets. The research was part of her wider thesis on Māori future foods.

She was one of 53 students who competed in 3- or 10-minute presentations as a part of the 2024 Riddet Institute Student Colloquium.

Quitara Naera.

Future doctor wins science communication award

Pūhoro STEMM Academy summer intern Quitara Naera's (Ngāpuhi, Ngāti Whakaue) communication skills saw her winning the 2024 Pūhoro STEMM Communication Award. At the Pūhoro Internship Programme 2024-2025 Pō Whakanui event held on February 12, 2025, to mark the end of the programme, Quitara won the award for her academic poster. The poster detailed her research during her internship with the Riddet Institute for the 2024-2025 summer. Her research topic was: Improving the Fermentation Efficiency of a Lentil Based Substrate. Quitara is currently studying a Bachelor of Medicine and Bachelor of Surgery at the University of Otago.

Two new Pacific master's students join Riddet Institute

Tau Tohi presenting at the student colloquium.

Two new students with Pasifika backgrounds have begun their master's degree studies in 2024.

Ahotau Tohi (Tonga) is researching competitive adsorption between dairy proteins and non ionic surfactants.

Thomas Liebregts (Tonga/Fiji) is studying for a Master of Food Technology and is researching diagnostic tools for assessing pathogens that cause gastrointestinal illness from seafood consumption.

Ahotau and Thomas join another Pacific student, Salanieta Naliva (Fiji) who is doing her PhD on determinants of nutrition and health risks associated with malnutrition in older adults in Fiji.

Her research will directly help improve the lives of Pacific people.

The Institute also supported two Māori students undertaking a master's degree.

Asher Brooke (Ngati Porou) is researching the effects of milk oligosaccharides on the gut microbiota for her master's thesis.

Simone Frame (Ngāti Maniapoto/Ngāti Kahungunu) completed her master's degree studies investigating Aotearoa New Zealand banana varieties and their impact on infant gut microbiota in 2024.

From left: Asher Brook and Simone Frame.

NEW NON-DAIRY CREAM WHIPS UP EXCITEMENT

ANDFOODS scientists, from left, Dr Alejandra Acevedo-Fani, Dr Arup Nag, Dr Debashree Roy and Yiran Wang.

A new plant-based dairy cream and milk developed at the Riddet Institute caught the news media's attention in 2024.

The product is derived from a legume that grows in India. A novel patented scientific process involving fermentation has produced cream and milk, among other food products, while maintaining the legume's nutritional and functional properties.

The cream's ability to take on air and maintain its shape has eclipsed all other plant-based creams in kitchen testing. It is now close to commercial release after five years' development and testing.

A team of scientists, entrepreneurs, and marketers were assembled to guide the promising start-up in 2023, initially called Saber Dairy Free Ltd, but branded as ANDFOODS in 2024.

"I think it's got some really unique properties," says ANDFOODS Board Chair Leon Clements. "It's a novel ingredient, and can play a role in how consumers and food companies are trying to navigate global system change."

Mr Clements says there is a big consumer shift at present towards health and wellness, as well as concerns about the environment and future sustainability of food supply using conventional means.

ANDFOODS

"It's a novel ingredient, and can play a role in how consumers and food companies are trying to navigate global system change."

Cream of the crop

A creative appetite for food innovation has led to a new product to fill a gap in the plant-based milk market.

Plant-based milk tech is finding market favour

"This start-up will tick these boxes"

ANDFOODS new products include a milk with exceptional frothing properties for your flat white, and the whipping cream that is easy to whip up and pipe onto pastries. Importantly, it is as tasty as conventional dairy cream.

Riddet Institute Director Dist. Prof Harjinder Singh says the team showed amazing dedication over four years to invent the products. They were working on the project, while also having full-time jobs and overseeing students.

"They have unlocked something completely new. Everyone is thinking about dairy-free. This team has come up with a unique source. It is a complete transformation from a lentil to milk. It also has an amazing ability to foam because of the process."

The work has led to two patents. ANDFOODS is now investigating the commercialisation of the products and accelerating research and development after receiving significant seed funding.

The concept was reported 20 times by news media outlets in 2024, in New Zealand and around the world, with Food Innovation Team Leader and ANDFOODS CTO Dr Arup Nag appearing in several magazine, print media and radio news stories. Extra interest was sparked by Dr Nag's success as a finalist in the KiwiNet Research Commercialisation Awards in 2024.

One refrain was common to all media enquires: "Can I taste it?"

The Riddet Institute makes headlines

Riddet Institute advances in food and nutrition science, international events and recognition of scientific excellence were in the news in 2024.

Food and health are at the core of Riddet Institute research activities, and new findings were sought after by the general public. Among the most widely published news stories were those about milk, wine, and a new plant-based whipping cream invention.

The Riddet Institute's milk and protein research often leads to topical news for farmers and food producers.

Dr Natalie Ahlborn's success in winning a major international award with her research on how heating, homogenising, or pasteurising affects the time taken to digest milk was popular news. Published by at least seven different news outlets, the farming press was particularly interested in Dr Ahlborn's award-winning research.

Findings from a study to investigate the effect of once-a-day milking on protein content, and a study on Chinese consumers increasing their milk consumption were popular, too. Other notable themes catching the eye of magazines and newspapers included healthy plant-based diets being much more expensive than those including animal-sourced foods, the importance of diet and exercise, and unhealthy snack choices.

Another article arising from Riddet Institute research with real-world impact concerned the trade in food. It explained that supplying sufficient nutrients to the human population relied on trading food ingredients between countries. The subject proved topical. Appearing in The Conversation in February, the article "*Where did the ingredients in that sandwich come from?*" was republished a further 15 times in a range of national and international titles.

Stories that emphasised the Riddet Institute's global scientific excellence were also a hit with New Zealand news media. The Institute's international reputation in food science research was demonstrated again in November by hosting the International Hydrocolloids Conference.

The conference came to New Zealand only because of the Riddet Institute's leadership in food hydrocolloids research – news that was reported by media outlets across the country 11 times.

Leading the news was Riddet Institute Director Harjinder Singh himself. Dist. Prof Singh was featured several times over the year, receiving multiple accolades for scientific excellence: – topping the Stanford University rankings for food science in New Zealand, being bestowed with a Lifetime Achievement Award by the Institute of Food Technologists, named a KiwiNet Award finalist in the BNZ Researcher Entrepreneur section, awarded a prestigious Pickering Medal by the Royal Society Te Apārangi for his Ferri-Pro iron supplement research, and named in the New Year's honours as a Companion of the New Zealand Order of Merit.

The Riddet Institute is supporting R&D for business

Often the research and discoveries made at the Riddet Institute today become the new food products of tomorrow. The Riddet Institute Food Innovation Team supports innovation and commercialisation by seeking collaborations and funding that can turn promising new research findings into patented products. Previous successful commercialisation activities have included FerriPro™ iron encapsulation technology licensed to Nestlé, and several products developed for the Alpha Group (via the Massey-Alpha Natural Nutraceuticals Research Centre).

The Riddet Institute is increasingly working with start-up companies to provide expert advice, or research and development (R&D) to support the creation of novel technologies and products. The new product AndFoods is an exceptional example (see opposite page). Other recent start-ups the Institute has supported include the Miruku biotech start-up, which aims to produce dairy products using molecular farming techniques with plant cells to produce proteins, fats, and sugars. The technology would effectively circumvent dairy farming to make animal-free dairy foods and beverages. Miruku is an international collaboration that intersects future food, biotech and agriculture, with the Riddet Institute contributing its expertise in protein functionality.

The Riddet Institute works with key stakeholders to achieve impact, including its Strategic Industry Partners:

Zespri KIWIFRUIT · Fonterra · goodman fielder · WAKATŪ INCORPORATION · NUKU kite PUKU · food HQ Where food ideas meet science

ALIGNED PROGRAMMES

Food research projects benefit economy and build knowledge

Industry funding for aligned Riddet Institute research projects increased in 2024, especially from overseas sources, representing a rise in confidence in Riddet Institute activities.

The original research in food science and nutrition being carried out at the Riddet Institute, and its connections with food companies, is making an impact in the New Zealand food sector.

These research projects (listed below), and the connections made from them, will transfer advanced knowledge and innovation, building skills for New Zealand's economic benefit.

The Sustainable Nutrition Initiative® (SNi) is gaining significant recognition nationally and internationally, and continues to grow in size. Its influence has also grown with new funding received from industry and government in New Zealand and internationally.

Forming part of the Riddet Institute, the Sustainable Nutrition Initiative® is a team of researchers who make evidence-based nutrition research accessible to help bring about globally sustainable nutrition.

In 2024 it was awarded more than US$2 million (NZ$3.4) from the Gates Foundation in a three-year contract to develop an interactive food system scenario model for Kenya. The funding commences in February 2025, with the computational model building upon existing successful mathematical models. These models include the DELTA Model® modelling global food and nutrient supply, and another concerning global trade in nutrients. In a programme co-led by the Riddet Institute and hapū entity, Wakatū Incorporation, the team is also working on a sustainable food system model for Aotearoa New Zealand, backed by the government's Endeavour Fund ($10 million).

The Kenya model will be interactive and able to test scenarios, showing the implications of future changes to the food system, enabling high-quality, evidence-based decision-making, providing Kenyan authorities with the data to make policy decisions.

As with other modelling scenarios, it will capture the interconnections between agricultural and food production, food trade, human nutrition, environmental impacts, and financial consequences.

In the future the model could support land use policy, food trade policy, public health policy, and investment decisions. The Riddet Institute is working with Kenyan-based researchers in the project, who will provide data and local expertise from Kenya.

SNi® produces data and modelling programmes to enable better understanding of the food system and the opportunities to sustainably feed the global population, national and regional populations, and individuals. It aims to generate new insights into sustainable food systems and diets based on the best available evidence. The initiative is led from the Riddet Institute by Prof Warren McNabb, in collaboration with other industry participants and experts.

Fermentation-Produced Protein (FPP) model

Building on its suite of modelling tools, SNi® also launched the Fermentation Produced Protein (FPP) model in 2024. This interactive tool assesses the potential of fermentation-derived proteins to contribute to global protein needs. It quantifies environmental impacts such as land use, energy demand, and greenhouse gas emissions under different production scenarios. For example, producing an additional: **18 million tonnes** of protein through fermentation could require **10–25 million hectares** of cropland, up to **1%** of global electricity, and result in **159 million tonnes** of CO_2 equivalents. The model provides evidence-based insights to inform sustainable protein production strategies. The development of the model was supported by contributions from key research collaborators, such as Fonterra.

High-Value Nutrition (HVN) National Science Challenge wraps up

The Riddet Institute was the lead research partner for the government's High-Value Nutrition (HVN) Science of Food programme, which came to an end in 2024. The programme included the following 2024 activities:

- With NIG Nutritionals, a clinical trial of powdered milk consumption (bovine, ovine, caprine) on digestive comfort in an elderly cohort was completed at the University of Otago. The team are now analysing the clinical data and writing up the project. This research is in collaboration with the MBIE-funded NZ3M programme, led by the Riddet Institute, and also involves Miraka and Spring Sheep Dairy.
- An HVN "Mānuka Honey for Digestive Health" project led by Professor Nicole Roy from the University of Otago and Professor Warren McNabb at the Riddet Institute was also progressing. The clinical study has finished and data analysis is continuing.
- A stand-alone Priority Research Programme under the HVN umbrella on infant gut health is still progressing in 2024.

Plant-Based Food Ingredients

A Systems Approach to Sustainable Design

Five-year project to unravel the nutritional power New Zealand's arable crops commences

A new Plant-Based Food Ingredients research programme aims to unlock the potential of cropping plants as high-value future foods.

Led by AgResearch and funded by MBIE until 2028 for $13.7 million, Plant-Based Food Ingredients is a major collaboration between the Riddet Institute and its CoRE partners Plant & Food Research and Massey University, plus the NZIER and Australia's CSIRO. The project aims to invigorate the processing industry for New Zealand's arable crops.

The starting points for investigation are oats, peas and hempseed, which represent cereals, legumes and oilseeds respectively.

The Riddet Institute has been allocated $2.25 million over 5 years with a special focus on unravelling the nutritional and techno-functional properties of novel food ingredients derived from these crops. The studies are focusing on oats and how the protein fractions can be formulated into food products appealing to global consumers.

The Riddet Institute team, led by Dr Alejandra Acevedo-Fani, is

based in Palmerston North and includes Dr Thomas Do, PhD student Catarina Ferreira, Prof Aiqian Ye, and Dist. Prof Harjinder Singh. Dr Suzanne Hodgkinson forms part of the nutrition team for this project. Consumers are increasingly looking to cereals, legumes and oilseeds to do more – to meet a wider range of culinary and nutritional needs, and to help address global concerns around sustainable ecosystems. New Zealand can participate in this opportunity by developing the science and technologies to produce unique highly functional plant foods with this research. The programme includes designing models of crop fractionation processes that incorporate eco-sensitivity, value chain dynamics and circular bioeconomy, and maximising ingredient techno-functionality and health benefits.

MBIE Catalyst programmes finish in 2024

The Riddet Institute contributed to several programmes funded by the Ministry of Business, Innovation and Employment (MBIE) which had significant industry involvement. Examples include:

Professor Joanne Hort (Principal Investigator, Massey University) is leading Te Rangahau Taha Wheako mō ngā Kai o Āpōpō: The Consumer Dimension of Future Foods, which involves a number of New Zealand industry partners: NZ Algae Innovation, Goodman Fielder, Fonterra, Movers in Hemp Innovation (MiHI), Wakatū Incorporation, NUKU ki te PukuTM, Vince and Food Nation.

Dr Arup Nag and Dist. Prof Harjinder Singh collaborate with the Cawthron Institute-led programme to investigate the potential of the red seaweed Karengo and the microalga Chlorella as everyday alternative protein sources.

Dr David Everett (Principal Investigator Riddet Institute and AgResearch) is a senior investigator on a project co-led by Dr Linda Samuelsson (AgResearch) and Dr James Chan (A*STAR, Singapore) on the cooking and processing of seaweed to improve consumer acceptance, protein digestion and nutrient bioavailability.

Dr Laura Domigan (Associate Investigator) leads a team exploring the development of successful hybrid foods using plant proteins (soybean and pea) and cultured livestock cells (including cattle, sheep, deer and pig).

Protein database built from Proteos

The Riddet Institute spearheads an international collaborative research team in the Proteos programme, led by Dist. Prof Paul Moughan and Dr Suzanne Hodgkinson. The second phase of the programme to develop a global database of protein quality from commonly consumed foods was funded in 2021 by a consortium of international food companies led by the Global Dairy Platform.

The funding amounted to US$1.5 million. The resulting database on protein quality and digestibility was a significant topic at the International Symposium on Dietary Protein for Human Health, held in Utrecht in September 2023. The work on the now-completed database and the success of the Utrecht conference has led to another invited conference on the topic in Orlando in 2025, organised by the Riddet Institute and the University of Illinois, as well as a Special Edition of the Frontiers in Nutrition journal (see page 32).

Other research projects

- Dr Alejandra Acevedo-Fani leads a $476,000 project with Fonterra investigating milk ingredient behaviour during digestion for infant nutrition.
- In its fourth and final year, a project assessing the quality and nutritional potential of proteins extracted from Irish marine, meat and dairy sources is underway, with Dr Suzanne Hodgkinson project leader for a Walsh Fellowship in collaboration with Teagasc, Ireland.

The Riddet Institute seeks to celebrate diversity at all levels of our organisation. We are committed to the proactive development of staff and students in the Institute and the inclusion of people from under-represented groups. We consider that a culture embracing equity and diversity is intrinsic to better science and innovation.

OUR PEOPLE

SCIENTIST LEADING THE FUTURE OF SUSTAINABLE PROTEIN INNOVATION

Professor Jaspreet Singh is leading an important shift in sustainable food innovation, developing new ways to create high-quality meat alternatives from low-value by-products.

His patented method transforms less refined and other plant ingredients and low-value dairy or meat proteins into high-quality, fibrous 'hybrid meat analogues' that mimic the texture of prime meat cuts, without the need for harsh chemical processing. This innovative research is supported by Smart Idea funding from the Ministry of Business, Innovation and Employment (MBIE). By transforming what was once considered food waste into premium, nutritious protein products, this innovation opens exciting new export opportunities for New Zealand's meat and dairy sectors.

Professor Jaspreet Singh is revolutionising hybrid meat research.

Professor Singh and the research team continue to work closely with industry partners to refine ingredient sourcing and further explore how these textures are formed at a molecular level.

AWARD SEASON FOR RIDDET INSTITUTE DIRECTOR

In 2024, Dist. Prof Harjinder Singh received global recognition for his work in food science.

He was awarded the prestigious Pickering Medal by the Royal Society Te Apārangi for how his science has innovated the food industry, including developing FerriPro™, a patented iron-protein complex addressing iron deficiency – a condition affecting over 1.6 billion people worldwide. FerriPro™ offers a stable, bioavailable iron source that maintains food quality. In 2019, Nestlé acquired the technology, marking the largest commercial licensing deal in Massey University's history. The product was launched in Pakistan as BUNYAD IRON+, aiming to improve iron intake among children in emerging markets.

In June, Dist. Prof Singh received the Institute of Food Technologists' Lifetime Achievement Award, becoming the first individual from New Zealand or Australia to earn this distinction. This award recognises his lifetime contributions to the science of food, including his role in advancing multi-disciplinary alliances between food science and nutritional science.

His entrepreneurial impact was also celebrated through a finalist nomination in the 2024 KiwiNet Awards, under the BNZ Researcher Entrepreneur category, for his leadership in translating scientific discoveries into real-world solutions. Capping off a year of achievements, he was appointed a Companion of the New Zealand Order of Merit in the 2025 New Year Honours, recognising his service to food science and technology.

Dist. Prof Harjinder Singh receives his award from IFT President Sean Leighton.

With over 500 scientific publications, 25 patents, and leadership roles in start-ups like Miruku and ANDFoods, Dist. Prof Singh continues to influence food innovation globally – improving health, nutrition, and the science behind what we eat.

Notably, Dr. Arup Nag, CTO of ANDFOODS and a key collaborator of Dist. Prof Singh, was named a finalist for the Sprout Agritech Breakthrough Innovator Award at the 2024 KiwiNet Awards. His work on shelf-stable probiotics and high-protein, dairy-free cheese alternatives has garnered attention for its potential to revolutionise the plant-based dairy sector.

SUMMER STUDENTS GETTING A TASTE OF FOOD RESEARCH

Some of the 14 Riddet Institute summer students, from left, Ruby (Rubi) Smith, Quitara Naera, Yuanhao Wang, Presley Paraku, Arlo Rea, Ella Hall and Jiayin (Shirley) Yuan.

In 2024 the Riddet Institute welcomed 14 summer interns, including five tauira (students) from the Pūhoro STEMM Academy, a partnership with the Riddet Institute based on the shared vision to develop Māori capability and capacity in science. A mix of returning students and new faces worked at Massey University or the University of Otago on food and nutrition projects.

The Institute welcomed Ruby (Rubi) Smith, Quitara Naera, Yuanhao Wang, Presley Paraku, Arlo Rea, Ella Hall, Jiayin (Shirley) Yuan, Pounamu MacKay, Meg MacGregor-Dunn, Chu (Quinn) Vy in Palmerston North, and Tate Agnew, Sammi Ammar, India Diack, and Kayla Vette at Otago.

- **Arlo Rea** researched the relationship between food prices and nutrient density.
- **Ella Hall** explored creating land use scenarios for the MBIE-funded programme 'Kai anamata mō Aotearoa' known as the KAMA model.
- **India Diack** (Ngāti Ruanui me Ngā Rauru) researched the impact of culture on food choice motives.
- **Jiayin (Shirley) Yuan** researched the Physicochemical characterisation of plant proteins.
- **Meg MacGregor-Dunn** (Muaūpoko) explored carbohydrate profiling of a plant-based milk (Pūhoro STEMM Academy).
- **Pounamu MacKay** (Ngāti Raukawa, Ngāti Kahungunu ki Wairarapa, Ngāi Tumapuhia, Ngāti Toa Rangatira) researched improving fermentation yield and process of a plant-based milk base (Pūhoro STEMM Academy).
- **Tate Agnew** (Ngāpuhi) looked at Ngaro huruhuru (NZ native bee) pollen foraging.
- **Presley Paraku** (Ngāti Maniapoto/Ngāti Tamaterā) explored how the physical structure of protein bodies from hempseed change under different environments (Pūhoro STEMM Academy).
- **Quinn Vy** investigated how food structure impacts the kinetics of calcium release during *in vitro* gastric digestion.
- **Quitara Naera** (Ngāpuhi/Ngāti Whakaue) research topic was about improving the fermentation efficiency of a lentil based substrate (Pūhoro STEMM Academy).
- **Rubi Smith** (Rangitāne o Manawatu) worked on developing implicit measures of consumer response (Pūhoro STEMM Academy).
- **Sammi Ammar** (Samoa) investigated diabetes education resources for Pacific people (<25 years of age) newly diagnosed with type 2 diabetes in Aotearoa New Zealand.
- **Yuanhao Wang** researched milk protein digestion.
- **Kayla Vette** (Ngati Porou) researched expiry date labelling.

STUDENTS SHINE IN COMMUNICATION COMPETITION

Our star of the stage was Summer Wright (Ngāti Maniapoto) who won the student communicator award 2024 at the student colloquium in September (see page 33 for more).

Close behind was Vitor Geniselli da Silva, presenting his research on the infant microbiota and the difference that first foods could make to baby gut health.

In the 3-minute competition, our winners were first: Manfred Goh with an entertaining presentation on amino acid absorption, and second: Ayşenur Arslan speaking on protein fermentation in the human colon. An honourable mention prize went to Shien Ping Ong for her research presentation on milk consumption in older women.

(From left to right: Shien Ping Ong, Vitor Geniselli da Silva, Ayşenur Arslan, and Manfred Goh).

GRADUATES HEAD TO A WIDE RANGE OF CAREERS

Many of our students and emerging scientists go on to a career in food research or the food industry. We prepare our young scientists for this through industry-ready training. Some students and staff who have recently started careers in industry and research are highlighted below.

Alexander Kanon

Research Officer (Industry Project Manager), APC Microbiome, Ireland

Dr Alex Kanon's journey to the Riddet Institute was driven by a curiosity about how nutrition impacts human health. After earning a bachelor's degree in food science and nutrition, he pursued an honours degree in physiology, focusing on preterm infant nutrition and brain development, both from the University of Queensland. He began his career at CSIRO, where he developed expertise in protein research and food functionality.

At the Riddet Institute, his PhD research delved into the effect of kiwifruit on sleep, neurotransmitter metabolism, and the gut microbiome, shedding light on the gut-brain connection. Currently, as Industry Project Manager at APC Microbiome, University College Cork, Ireland, Alex leads microbiota-gut-brain axis projects for global clients, driving innovation and impactful collaborations.

Mengxiao Yang

Research Technologist, Fonterra

Dr Mengxiao Yang holds a Master of Food Technology from Wageningen University, the Netherlands, and completed an internship at the University of British Columbia in Canada. She joined the Riddet Institute for her PhD after discovering an opportunity within the New Zealand Milk Means More (NZ3M) programme. Mengxiao focused her research on milk protein interactions with the enzyme pepsin, contributing valuable insights into milk digestion.

Her work included investigating the kinetics of k-casein hydrolysis by pepsin; exploring protein structural formation and breakdown through utilising small-angle scattering techniques.
Currently, Mengxiao is a Research Technologist at Fonterra's R&D Centre, working on product development and innovation in the cheese foods team. Her research excellence has earned several accolades, including second place n the Pieter Walstra Award and the AINSE Post Graduate Research Award.

Lirong Cheng

Research Technologist, Fonterra Research and Development Centre, New Zealand

Dr Lirong Cheng holds a Bachelor of Food Science and Engineering from Southwest University of Nationalities (China) and a Master of Food Technology from Wageningen University & Research (Netherlands), specialising in dairy science and technology. During her master's, Lirong interned at the Nutricia Research Centre in Utrecht, where she worked on developing an infant digestion model for formula screening. This sparked her interest in food emulsions and digestion, leading her to pursue a PhD at the Riddet Institute.

Her research there deepened her expertise in food emulsion technology and protein sciences, which was also acknowledged as a Dean's list exceptional doctoral thesis. After her PhD, she was appointed as a Postdoctoral Fellow at the Riddet Institute before taking up her current role as Research Technologist at Fonterra's R&D Centre, where she focuses on cream cheese innovation and continues to develop her expertise in food emulsion structural design, bridging protein and lipid science.

Caterina Carco

Postdoctoral Fellow in Bioinformatics, Malaghan Institute of Medical Research

Dr Caterina Carco graduated with a Bachelor of Medical Biotechnology from Italy and a Master of Molecular Medicine from the UK, where she developed a strong foundation in biotechnological approaches to human health. Her research interests led her to the Riddet Institute, where she pursued a PhD focused on the microbiome-immune system interactions in functional gastrointestinal disorders (FGIDs).

Caterina's research explored the relationship between gut microbiota, immune cell function, and gastrointestinal symptoms, revealing potential food-based interventions, such as kiwifruit, to support gut health.

After completing her PhD, Caterina moved into bioinformatics as a Postdoctoral Fellow at the Malaghan Institute, focusing on immune responses in the skin and gut.

Her long-term aspirations include advancing research on colorectal cancer prevention and exploring the impact of food contaminants on health. Caterina's work has earned recognition, including Best Poster at Foodomics 2019.

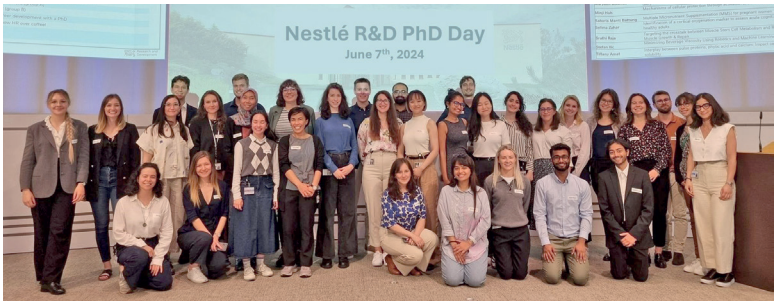
STUDENT SUCCESS

Our students and postdoctoral fellows achieve at the highest level. Some outstanding student achievements from 2024 are:

Foodomics 2024 Poster competition success

Two PhD students, **Vito Geniselli da Silva**, left, and **Simone Frame**, were recognised at the Foodomics 2024 conference for their research.

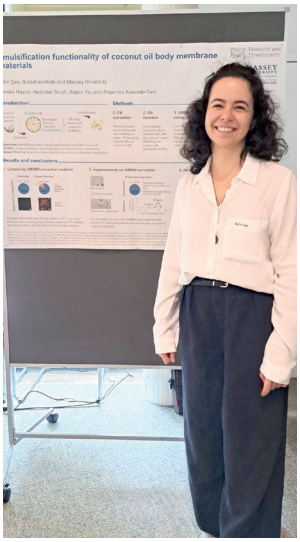
Simone Frame received the People's Choice Award for her work on 'Aotearoa bananas for feeding the infant gut microbiota.' Vitor Geniselli da Silva was awarded the Postgraduate Students Award for his research on identifying foods that nourish the infant gut microbiota through a combined *in silico* and *in vitro* approach. Their research contributes to the growing body of knowledge on food's role in gut health, particularly in early childhood.



PhD student's international experience with Nestlé Switzerland

Aylin Şen, right, had the unique opportunity to visit Nestlé Switzerland, where she presented her research on 'Emulsification functionality of coconut oil body membrane materials' at the Nestlé PhD Day. During her visit, Aylin engaged with fellow researchers from around the world, presented a poster, and toured Nestlé's renowned research centres in Lausanne and Konolfingen.

Aylin's PhD research focuses on understanding the functionality of coconut oil in food emulsification, with the potential to improve the texture and quality of food products.



PhD students in the spotlight

Our PhD students have been making significant strides this year!

01: **Sheba Culas**, won the People's Choice Award at Massey University's 3MT competition for her research on using Cinnamomum zeylanicum (Ceylon cinnamon) to manage diabetes.

02: **Isurie Akarawita**, secured second place at The University of Auckland's 3MT competition, advancing to the finals with her research on 'Smart Chewing Robots.'

03: **Hao Cui** placed third in the Elsevier-sponsored Poster Competition at the 17th International Hydrocolloids Conference for her work on quinoa protein in meat analogues. (Pictured third from the left, with Professor Sylvie Turgeon, left, Professor Mike Gidley and Professor Dougles Goff, far right).

04: **Ejovi Abafe** and **Patricia Soh** were both selected for the final of the Falling Walls Lab Aotearoa competition.

AWARDS & ACHIEVEMENTS

Our investigators are high-achieving researchers in their fields. The following investigators, students, and other personnel gained recognition during 2024 .

NAME	AWARD/APPOINTMENT
DR ALEJANDRA ACEVEDO-FANI (CoRE Principal Investigator)	→ Editorial Board Member for the journal, *Critical Reviews in Food Science and Nutrition.* → Awarded Erasmus mobility grant to enable collaboration with Institut Agro in France, a university closely connected with INRAE (€47,415).
PROF JOSE MIGUEL AGUILERA (Scientific Advisory Panel)	→ 2024 Distinguished Isaac Heerje Award at the Food Structure and Functionality Symposium held in Bruges, Belgium.
DR NATALIE AHLBORN (Key Researcher)	→ 2nd place in the International Dairy Federation (IDF) Professor Pavel Jelen Early Career Scientist Prize.
PROF BARBARA BURLINGAME (Adjunct Professor)	→ Visiting Scientist at Harvard University (T. H. Chan School of Public Health).
DR SYLVIA CHUNG CHUN LAM (Key Researcher)	→ Awarded Erasmus mobility grant to enable collaboration with Institut Agro in France, a university closely connected with INRAE (€47,415).
DR THOMAS DO (Key Researcher)	→ International Union of Food Science and Technology (IUFoST) Young Scientist Award.
DR AMANDA DUPAS DE MATOS (Key Researcher)	→ Awarded funding by Massey University (REaDI) for research project: Leveraging consumer preferences to maximise market opportunities for a by-product of the grape/wine industry ($10,000).
DR DAVID EVERETT (Research Leadership Group)	→ Appointed Vice President of the American Dairy Science Association for 2024-2025 term. → Made a Fellow of the American Dairy Science Association (April 2024).
DR SUZANNE HODGKINSON (CoRE Associate Investigator)	→ Appointed member of the International Atomic Energy Agency (IAEA). → Appointed member of the FAO/IAEA Protein Quality Database Technical Advisory Group. → Awarded Erasmus mobility grant to enable collaboration with Institut Agro in France, a university closely connected with INRAE (€47,415). → Awarded funding by Palmerston North Medical Research Foundation for research project: Anabolic resistance in aging and the role of the limiting indispensable amino acid in determining the protein synthesis and breakdown responses to meal protein quality ($9,500). → Awarded funding through the Maurice and Phyllis Paykel Trust for her team's research project on: Anabolic resistance in aging and the role of the limiting indispensable amino acid in meal protein quality ($10,000).
AGNES HUTCHINGS (Technical Staff)	→ Awarded funding through Inside Out LLC ($200,000) and Hemp Connect Ltd ($50,000).
DR JANICE LIM (Key Researcher)	→ Awarded funding through ENZO Nutraceuticals Limited for the team's project on New Zealand pine bark ($182,000).
PROFESSOR WARREN MCNABB (CoRE Principal Investigator)	→ Awarded funding through Gates Foundation for research project: Interactive food system scenario model for Kenya (US$2.4 million).
DR ARUP NAG (Key Researcher)	→ KiwiNet Research Commercialisation Award finalist for ANDFOODS.

Our people / Awards and achievements continued...

NAME	AWARD/APPOINTMENT
DR INDRAWATI OEY (Research Leadership Group)	→ President-Elect (2024-2026) and incoming President (2026-2028) for International Society for Electroporation-Based Technologies and Treatments (ISEBTT). → Awarded funding through the Independent Research Fund, Denmark; for research project: Unravelling the inactivation of proteolytic and redox enzymes through pulsed electric field for better processing of food grade RuBisCO from green biomasses (2,159,137 kr).
DR OLIVIA OGILVIE (Key Researcher)	→ Named as one of Forbes 30 under 30 in Asia for 2024 under the category Healthcare and Science.
ASSOCIATE PROFESSOR MEI PENG (CoRE Associate Investigator)	→ Awarded the Marsden Fund for her research project on: How do sensory shifts shape our diet? Testing the neural mechanisms underpinning nutrient selection ($839,000).
DR ALI RASHIDINEJAD (Key Researcher)	→ Outstanding Book Award at the International Drying Symposium 2024 for the book, *Spray Drying Encapsulation of Bioactive Compounds.* → Member of the scientific committee for the 8th International Symposium on Phytochemicals in Medicine and Food and the 9th International Symposium on Phytochemicals in Medicine and Food (2-7 August 2024). → Editorial Board Member for the journal, *Critical Reviews in Food Science and Nutrition.* → Awarded funding through Inner Mongolia Dairy Technology Research Institute for his team's project on FlavoPlus ($110,000).
DR DEBASHREE ROY (CoRE Associate Investigator)	→ KiwiNet Emerging Innovator Award.
DIST PROF HARJINDER SINGH (Director)	→ Nicolas Appert Lifetime Achievement Award (Institute of Food Technologist, USA) presented at the IFT Conference, Chicago (14 July 2024). → Pickering Medal by the Royal Society Te Apārangi, recognising his pioneering research and development of innovative food technologies and, in particular, research that led to the commercialisation of FerriPro™, a patented technology to combat iron deficiency. → Companion of the New Zealand Order of Merit in the 2025 New Year Honours in recognition of his significant contributions to food science and technology over a career spanning more than 30 years. → Editorial Board Member for the journal *Critical Reviews in Food Science and Nutrition.* → KiwiNet Research Commercialisation Award finalist with ANDFOODS.
PROFESSOR JASPREET SINGH (CoRE Principal Investigator)	→ Awarded the Ministry of Business, Innovation and Employment Smart Idea funding for his research project on: A circular food technology to create whole-plant food analogues (WpfA) ($1 million).
DR NICK SMITH (CoRE Associate Investigator)	→ Appointed to International Science Council's (ISC) Global Roster of Experts.
DR MAHYA TAVAN (Key Researcher)	→ Falling Walls Lab Aotearoa finalist.
PROFESSOR LISA TE MORENGA (CoRE Principal Investigator)	→ Promoted Professor at Massey University (starting January 2024).

NAME	UNIVERSITY	AWARD/APPOINTMENT
EJOVI ABAFE	Massey University	→ Falling Walls Lab Aotearoa finalist.
ISURIE AKARAWITA	University of Auckland	→ 2nd place in the University of Auckland Three Minute Thesis Competition (August 2024). Presentation entitled: "Smart Chewing Robots".
AYŞENUR ARSLAN	Massey University	→ 2nd place, 3-minute presentation, Student Colloquium.
HAO CUI	Massey University	→ 3rd place, poster competition, 17th International Hydrocolloids Conference, November 2024.
SHEBA CULAS	Massey University	→ 'People's Choice Award' in the Massey University Three Minute Thesis Competition (September 2024). Presentation entitled: "Transforming Cinnamon into a Diabetes Fighter".
SIMONE FRAME	Massey University	→ People's Choice Award for her poster presentation at Foodomics Conference, Wellington (19-21 March 2024).
VITOR GENISELLI DA SILVA	Massey University	→ 2nd place, 10-minute presentation, Student Colloquium. → Postgraduate Students Award for his poster presentation at Foodomics Conference, Wellington (19-21 March 2024).
MANFRED GOH	Massey University	→ 1st place, 3-minute presentation, Student Colloquium.
QUITARA NAERA	Massey University	→ Pūhoro STEMM Communication Award for her poster, Improving Fermentation Efficiency in Plant-Based Milk Bases at the Pūhoro STEMM Academy Pō Whakanui event February 2025.
SHIEN PING ONG	University of Otago	→ Special mention, 3-minute presentation, Student Colloquium.
SUMMER RANGIMAARIE WRIGHT	Massey University	→ 1st place, 10 minute presentation, Student Colloquium, winning the Ansley Te Hiwi Student Communicator Award.
AYLIN SEN	Massey University	→ Invited by Nestlé to present a poster at its PhD day and to tour its Lausanne and Konolfingen research centres (June 2024).
PATRICIA SOH	Massey University	→ Falling Walls Lab Aotearoa finalist.
MENGXIAO YANG	Massey University	→ Nominee with honour for the Pieter Walstra Award (May 2024) for her PhD thesis "Study on the interactions between milk protein and digestive enzymes (pepsin).

KEYNOTE AND INVITED PRESENTATIONS AT CONFERENCES

Investigators gave several keynote and invited presentations at international and domestic conferences and events, as follows:

NAME	TITLE	EVENT	VENUE/DATE
Dist. Prof Paul Moughan	Protein quality and sustainable food systems – the metrics matter	United States Agency for International Development (USAID)	Washington DC, USA, 6 February 2024
Prof David Rowlands	Novel and targeted protein types for improved insulin sensitivity and metabolic outcomes in people with type 2 diabetes mellitus	Steno Thursdays Research Seminar	Steno Diabetes Centre Aarhus, Denmark, 22 February 2024
Prof David Rowlands	Arla Ingredients sponsored protein session: How dietary protein supports recovery and performance	Bo Ao Food and Health Conference & Expo	China, 25-29 February 2024
Dist. Prof Harjinder Singh	Gastric structuring of food materials to optimise nutrient absorption: challenges and opportunities	8th International Conference on Food Digestion (ICFD2024)	(Online) Porto, Portugal, 9-11 April 2024
Prof Phil Bremer	Unravelling the complexities of starch digestion: The role of food microstructure and food processing	Chinese International Forum on Food Safety and Health	China, 25-27th April 2024
Prof Joanne Hort	Imaging taste perception	New Zealand Physical Sciences and Engineering Medicine Conference	Palmerston North, NZ, 13 May 2024
Dr Nick Smith	The social role of meat to provide insights on how different food groups contribute to global and national nutrient supplies.	"Josué de Castro" International Conference on Food Security	São Paulo, Brazil, 27-29 May 2024
Dr David Everett	Milk fat globule membrane structure with phytosterol replacement of cholesterol	American Dairy Science Association's Annual Meeting	Florida, USA, 16-19 June 2024
Dist. Prof R. Paul Singh (Harraways Visiting Professor)	Plenary: Diversity in food processing for a resilient food system	NZIFST Conference	Hamilton, 2-4 July 2024
Dist. Prof Paul Moughan	Plenary: Quality and sustainable food systems – the metrics matter	Korean Society of Food Science and Technology (KoSFoST) Conference	Daegu, Korea, 3-5 July 2024
Dist. Prof Paul Moughan	PDCAAS and DIAAS as an assessment of amino acid score and use of human milk pattern as reference	Advances in the Science to Assess Quality Factors for Infant Formulas in United States Workshop of the National Academies of Sciences, Engineering, Medicine	(Online) Washington DC, USA, 9-10 July 2024
Dr Faith Descallar	Plenary: Structural changes of milk during gastric digestion: Implications for nutrient delivery	8th Medical Biophysics Symposium	Bohol, Philippines, 11 July 2024
Dr Ali Rashidinejad	Phytochemicals in native New Zealand flora for functional foods and medicinal applications	8th International Symposium on Phytochemicals in Medicine and Food	Shenyang, China, 2-6 August 2024
Prof Phil Bremer	Climate change means more adverse weather events: Lessons from the New Zealand horticultural industry responses to Cyclone Gabrielle	International Fresh Produce Safety Centre Symposium	Sydney, Australia, 20-21 August 2024
Prof Joanne Hort	Opening Keynote: Cross-cultural differences in perception: A current perspective	11th European Conference on Sensory and Consumer Research (EUROSENSE 2024)	Dublin, Ireland 8-11 September 2024
Prof Gail Bornhorst	Riddet Institute Session (Co-Chair): Mechanisms of breakdown of foods with varying properties during gastric digestion	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Dr Debashree Roy	Riddet Institute Session: Differences in gastric protein digestion in piglets following consumption of cow, goat, and sheep whole milk	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Dr Thomas Do	Effects of heat treatment on the microstructure and trypsin hydrolysis of protein bodies from hempseeds (Presented as IUFoST International Young Scientist Award winner)	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Prof Indrawati Oey	Plenary: Pioneering sustainable food production with pulsed electric field technology	5th World Congress on Electroporation and Pulsed Electric Fields	Rome, Italy, 15-19 September 2024
Prof Indrawati Oey	Keynote: Pulsed electric fields in meat and fish and their by-products	5th World Congress on Electroporation and Pulsed Electric Fields	Rome, Italy, 15-19 September 2024
Prof Munish Puri	Microbial biomass harvesting for production of alternative proteins, fats and functional foods	Bioprocessing Network Australia Conference	Brisbane, Australia, 8-10 October 2024
Dr Sylvia Chung Chun Lam	Place of dairy in sustainable healthy diets: bridging nutrition and economy	International Dairy Federation (IDF) World Dairy Summit	Paris, France, 15-18 October 2024
Dr Andrew Fletcher	Environmental impact of precision fermentation	International Dairy Federation (IDF) World Dairy Summit	Paris, France, 15-18 October 2024
Dr Ali Rashidinejad	Charting the future of functional foods: Navigating obstacles and embracing projects	30th National Congress and the 5th International Congress of Food Science and Technology of Iran	(Online) Tehran, Iran, 16-18th October 2024
Dist. Prof Paul Moughan	Dairy in a changing world: Protein sustainability	GDP NOURISH 2024 Conference	Paris, France, 17 October 2024
Prof Aiqian Ye	Composition and processing impact on coagulation properties and digestion of milk proteins from non-bovine specifies	Food Science Frontier Research Conference organised by the International University Consortium of Food Science and Nutrition	Hangzhou, China, 30-31 October 2024
Dr Alejandra Acevedo-Fani	Nature-assembled structures from seeds as the next-gen of protein and lipid ingredients	Food Science Frontier Research Conference organised by the International University Consortium of Food Science and Nutrition	Hangzhou, China, 30-31 October 2024
Dist. Prof Paul Moughan	Opening address: Food structure and digestion	17th International Hydrocolloids Conference	Palmerston North, NZ, 12-15 November 2024

Prof Aiqian Ye	Intragastric colloidal behaviours and restructuring: Manipulating the digestive outcomes	17th International Hydrocolloids Conference	Palmerston North, NZ, 12-15 November 2024
Dr Alejandra Acevedo-Fani	Exploring hempseed cellular components for the next-gen food innovations	17th International Hydrocolloids Conference	Palmerston North, NZ, 12-15 November 2024
Dr Skelte G. Anema	The magic of milk proteins	17th International Hydrocolloids Conference	Palmerston North, NZ, 12-15 November 2024
Dr Natalie Ahlborn	Modelling global food systems: The place of dairy in sustainable nutrition	FAO Regional Forum on Innovations to Support Sustainable Livestock Transformation in the Asia and Pacific Region	Khon Kaen, Thailand, 14 November 2024
Prof Munish Puri	An introduction to life cycle assessment	Green Chemistry Conference	Melbourne, Australia, 12-16 December 2024

OTHER ORAL PRESENTATIONS

Dist. Prof Harjinder Singh	Science of Food Programme introduction	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Prof Nicole Roy	Digestive Health Programme introduction	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Prof Pamela von Hurst	Greenshell mussels for early signs and symptoms of osteoarthritis	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Prof Pamela von Hurst	Pāmu deer milk	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Assoc. Prof Jennifer Miles-Chan	Introduction to PANaMAH (Peak Nutrition for Metabolic Health) programme	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Dr Ivana Sequeira-Bisson (affiliated researcher)	The New Zealand SYNERGY Study	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Dr Jane Mullaney	Maramataka, provenance of kānuka oil, tea, floral water and leaves	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Dr Meika Foster	Tūhauora: multidisciplinary investigation of the functional properties of the taonga, kawakawa	Foodomics Conference	Wellington, NZ, 19-21 March 2024
Dr Nick Smith	Role of meat in sustainable nutrition?	AgResearch Meat Industry Workshop	Palmerston North, NZ, 26-27 March 2024
Assoc. Prof Lovedeep Kaur	Meat preservation through innovative strategies	AgResearch Meat Industry Workshop	Palmerston North, NZ, 26-27 March 2024
Dr Caroline Thum	Comparing venison	AgResearch Meat Industry Workshop	Palmerston North, NZ, 26-27 March 2024
Prof Phil Bremer	Plastic residue	AgResearch Meat Industry Workshop	Palmerston North, NZ, 26-27 March 2024
Dr Mahya Tavan	Global Alliance for Improved Nutrition (GAIN)-sponsored Symposium: Optimising diets for nutrition, sustainability, affordability, and acceptability with the iOTA model	32nd International Conference of Agricultural Economists (ICAE 2024),	Delhi, India, 2-7 August 2024
Prof Jaspreet Singh	Unravelling the complexities of starch digestion: The role of food microstructure and food processing	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Assoc. Prof Lovedeep Kaur	Replacing synthetic preservatives in foods with natural alternatives	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Dr Simon Loveday	Dairy vs. non-dairy cheese texture: Sensory and instrumental contrasts	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Dr Simon Loveday	Meat analogues: How do they 'steak up' nutritionally?	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Dr Sylvia Chung Chun Lam	The affordability of low-cost nutritious diets in the United States and New Zealand	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Dr Ao Chen	Unveiling Chinese older adult consumer perceptions: Exploring preference for imported milk with a New Zealand focus	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Dr Mahya Tavan	Where do plant-based milk alternatives fit in a nutritionally adequate diet?	NZIFST Conference	Hamilton, NZ, 2-4 July 2024
Dr Amanda Dupas De Matos	Thinning grapes to win: Exploring the use of unripe grapes for reduced-sodium pickle production	11th European Conference on Sensory and Consumer Research (EUROSENSE 2024)	Dublin, Ireland, 8-11 September 2024
Prof Indrawati Oey	Pulsed Electric Field as an innovative technology to structure nutritious legume-based foods	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Prof Indrawati Oey	Effect of PEF on endogenous lipase activity in trevally frames	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Prof Phil Bremer	The impact of media composition and temperature on the volatile organic compounds produced by lactic acid bacteria growing in defined media	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Prof Phil Bremer	Climate change means more adverse weather events: Lessons from the New Zealand horticultural industry responses to Cyclone Gabrielle	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024
Dr Ali Rashidinejad	Innovative encapsulation of New Zealand hops extract: A study on its delivery in a functional orange juice	22nd IUFoST World Congress	
Dr Ali Rashidinejad	Coprosma species of Aotearoa New Zealand as a traditional food for the future: Unveiling its nutritional and bioactive treasures	22nd IUFoST World Congress	Rimini, Italy, 8-12 September 2024

Our people / Board

01: **Rt Hon Sir Lockwood Smith**
Chair

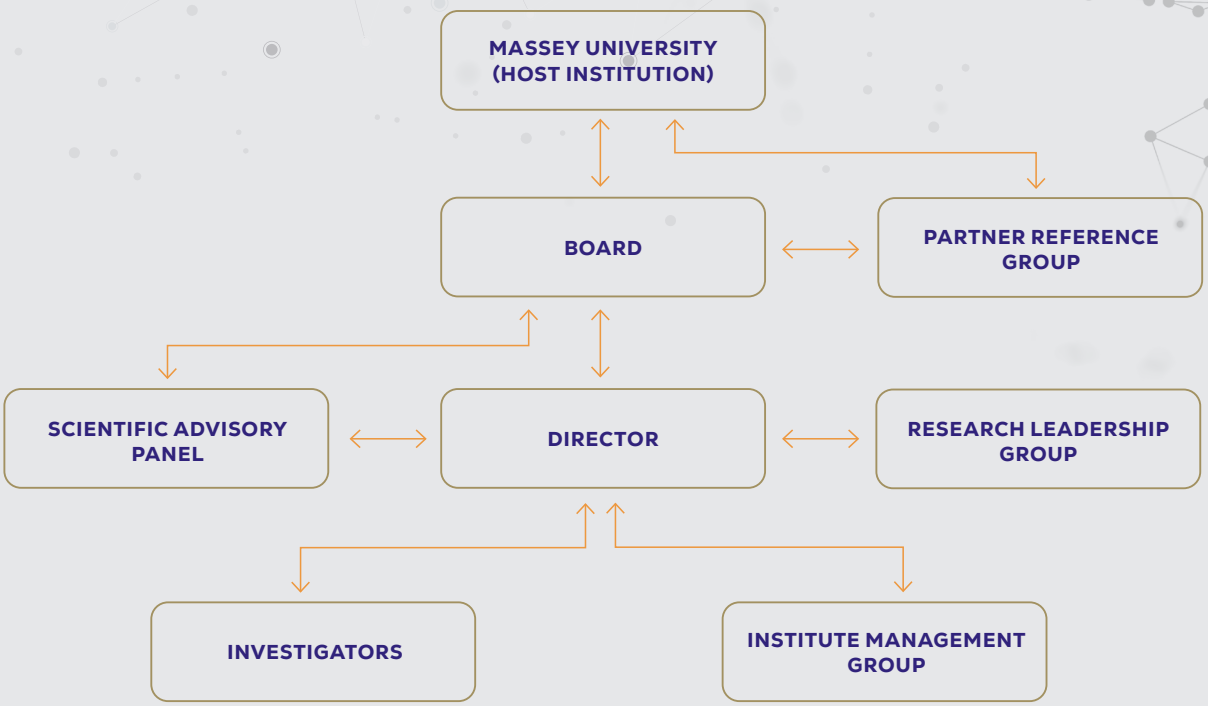
02: **Miriana Stephens**
Wakatū Incorporation

03: **Mark Piper**
Plant & Food Research

04: **Prof Jim Metson**
University Of Auckland

05: **Prof Jan Thomas**
Massey University

Our people / Governence and management structure



Our people / Partner reference group

01: Prof Phil Bremer
University of Otago

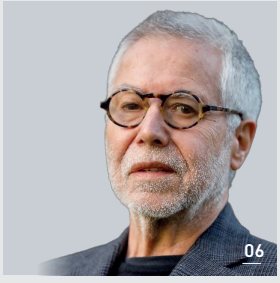
02: Dr Li Day
AgResearch

03: Dr Greg Murison
University of Auckland

04: Dr Jocelyn Eason
Plant & Food Research

05: Dr Viv Smith
Massey University

Our people / Scientific advisory panel



01: Prof Alastair Robertson (chair)
ex-CSIRO, Australia

02: Prof Manny Noakes
ex-CSIRO, Australia

03: Prof Rickey Yada
University of British Columbia, Canada

04: Prof Tracey McIntosh
University of Auckland, Aotearoa

05: Prof Oded Shoseyov
Hebrew University of Jerusalem, Israel

06: Prof José Miguel Aguilera
Pontificia Universidad Católica de Chile

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Independent Chair

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University of Auckland

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Wakatū Incorporation

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MANAGEMENT & ADMINISTRATION

Dist. Prof Harjinder Singh [1]
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Massey University

Prof Joanne Hort
Associate Director EDI
Massey University

John Henley-King
Associate Director Operations
Massey University

Dr Amelia Barker [2]
Communications Officer (Digital)
Massey University

Michelle Heayns
PA to Director
Massey University

Meeka Faamanu Mapuilesua
Finance Administrator
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Terri Palmer
Office Manager
Massey University

Hannah Ramsay [3]
Project Manager SNi
Massey University

Melanie Ruffell
Stakeholder Relationship Manager
Massey University

David Everett
Stakeholder Relationship Manager
Massey University

Wendy Shailer-Knight
Communications Officer
Massey University

Alex Wood
Administrator
Massey University

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University of British Columbia, Canada

Prof Manny Noakes
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Aotearoa

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Fonterra

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Research Officer
University of Auckland

Dr Jake Oh
Research Fellow
University of Auckland

Dr Nadun Palmada
Research Fellow
University of Auckland

Footnotes: [1] On sick leave for some of 2024 – Dist. Prof Paul Moughan appointed as Acting Director. [2] On parental leave for some of 2024 covered by Krishna Makwana. [3] On parental leave for some of 2024 covered by Deborah Stewart. [4] Riddet Fellows are senior researchers who have been Riddet Institute investigators and whose contribution to the Institute is recognised through this special status. They may retain involvement in the CoRE programme through advisory or supervisory roles.

Dr Zheng Pan
Postdoctoral Fellow
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Dr Ali Rashidinejad
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Dr Nikki Renall
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Massey University

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Khaled Kalam
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Barry Scott
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Massey University

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Yiran Wang
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Massey University

Yu Zhang
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Dr Peter Zhu
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Massey University

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Continuing study

Abhilasha Abhilasha
Massey University
Continuing study

Natalie Ahlborn
Massey University
Completed qualification

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Continuing study

Crisline Alhambra
Massey University
Continuing study

Safira Andayani
University of Otago
Continuing study

Geoff Ang
University of Auckland
Continuing study

Jin Ang
University of Canterbury
Continuing study

Ayşenur Arslan
Massey University
Continuing study

Norma Cecille Bagarinao
University of Otago
Continuing study

Marc Bailie
Massey University
Continuing study

Janita Botha
Massey University
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Ethan Cain
Massey University
Continuing study

Giovanna Castillo-Fernandez
Massey University
Continuing study

Sukanya Chakraborty
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Continuing study

Justine Coomson
Massey University
Continuing study

Hao Cui
Massey University
Continuing study

Sheba Culas
Massey University
Continuing study

Xuan Dong
University of Auckland
Continuing study

Sam Duanmu
University of Auckland
Continuing study

Hayleigh Frost
Massey University
Continuing study

Laura Gake Ombasa
University of Otago
Continuing study

Mariero Gawat
Massey University
Continuing study

Vitor Geniselli da Silva
Massey University
Continuing study

Manfred Goh
Massey University
Continuing study

Ai Ting Goh
University of Otago
Continuing study

Annelise Halafihi
Massey University
Continuing study

Aimee Harper
University of Canterbury
Continuing study

Maryam Hesabirad
Massey University
Continuing study

Nicholas Horlacher
University of Otago
Continuing study

Altaf Hossain
University of Otago
Continuing study

Yinxuan Hu
Massey University
Continuing study

Nan Hu
University of Otago
Continuing study

Alexander Kanon
Massey University
Completed qualification

Li Ying Lau
University of Auckland
Continuing study

Di Lu
Massey University
Continuing study

Sihan Ma
Massey University
Continuing study

Catherine Maidment
Massey University
Continuing study

Nyasha Makaza
Massey University
Continuing study

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Prishanthini Muthulingam
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Massey University
Continuing study

Linda Nezbedová
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Robin Nielsen
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Esther Onguta
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Continuing study

Supannikar Pakkethati
Massey University
Continuing study

Nabil Jamil Parkar
Massey University
Completed qualification

Peter Pendergast
University of Canterbury
Continuing study

Ruwanthi Premathilaka
Massey University
Continuing study

Jervee Malabanan Punzalam
University of Otago
Continuing study

Yusi Qin
Massey University
Continuing study

Asher Regan
Massey University
Continuing study

Shiyi Ren
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Continuing study

Aylin Sen
Massey University
Continuing study

Aysu Shahin
University of Otago
Continuing study

Qayyum Shehzad
Massey University
Continuing study

Bi Xue Patricia Soh
Massey University
Continuing study

Kai Steinmetz
University of Auckland
Continuing study

Litian Su
University of Auckland
Continuing study

Ubaid Syed
Massey University
Continuing study

Jacqueline Tonkie
Massey University
Continuing study

Hamish Trlin
University of Canterbury
Continuing study

Reza Vaseghi
Massey University
Continuing study

Xudong Wang
University of Auckland
Continuing study

Yuan Wang
University of Auckland
Continuing study

Prasadini Wasana Withanage
Massey University
Continuing study

Jie Long Jerome Wong
Massey University
Continuing study

Summer Wright
Massey University
Continuing study

Angela Wulansari
University of Otago
Continuing study

Chengyi Yang
University of Otago
Continuing study

Runji Zhao
University of Auckland
Continuing study

MASTER DEGREE STUDENTS

Treesa Antony
Massey University
Continuing study

Steven Benhur
Massey University
Continuing study

Haig Bishop
University of Canterbury
Continuing study

Asher Brook
Massey University
Continuing study

Kuan Yu Chiang
Massey University
Completed qualification

Simone Frame
Massey University
Completed qualification

Lakra Kartik
Massey University
Continuing study

Thomas Liebregts
Massey University
Continuing study

Samantha O'Connor
Massey University
Completed qualification

Miku Sciascia
Massey University
Continuing study

Scylla Sundheim
University of Auckland
Continuing study

Ahotau Tohi
Massey University
Continuing study

Weihan Zhang
University of Canterbury
Continuing study

FINANCIAL REPORT

INCOME AND EXPENDITURE OF CORE FUNDS

		BUDGET 2024 $000	ACTUAL 2024 $000
Income			
	CoRE Funding	5,100	5,100
	Surplus/Deficit carried forward	1,939	4,286
	Funds contributed by collaborative partners	0	283
	Total Income	**7,039**	**9,669**
Expenditure			
Salaries	**Total Salaries & Salary-related costs**	**1,482**	**1,510**
	as % of Total Expenditure	*25%*	*27%*
Other Costs			
Indirect Costs	Overheads	1,694	1,753
	as % of Total Expenditure	*29%*	*31%*
Direct Costs	Project Costs	776	487
	as % of Total Expenditure	*13%*	*9%*
	Travel	358	151
	as % of Total Expenditure	*6%*	*3%*
	Postgraduate students	1,535	1,384
	as % of Total Expenditure	*26%*	*25%*
	Equipment depreciation/rental	0	0
	as % of Total Expenditure	*0%*	*0%*
	Subcontractor(s) specified	17	283
	as % of Total Expenditure	*0%*	*5%*
	Extraordinary Expenditure	0	29
	as % of Total Expenditure	*0%*	*1%*
	Total Other Costs	**4,380**	**4,087**
	as % of Total Expenditure	*75%*	*73%*
Total CoRE Expenditure	**Total Expenses**	**5,862**	**5,597**
Net Surplus/(Deficit) - annual		(762)	(214)
Net Surplus/(Deficit) - cumulative		1,177	4,072

CO-FUNDING

		2024 ($000)
Government Funding	National Science Challenges	881
	Other MBIE	2,725
	Callaghan Innovation	-
	Health Research Council	104
	Marsden	-
	Non-vote	15
Non-Government Funding	Domestic	1,836
	International - Private Sector	1,750
	International - Public Sector	32
	University/Host/Partner support	-
	Total	**7,344**

SUMMARY OF DATA

VALUE OF CoRE FUNDING FROM TEC		$5.1 MILLION
FTEs by category	Principal Investigators	2.0
	Associate Investigators	0.7
	Postdoctoral Fellows	4.2
	Research technicians	2.3
	Administrative/support	2.4
	Research students	41 (approx.)
	TOTAL	**53.1**
Headcounts by category	Principal Investigators	27
	Associate Investigators	46
	Postdoctoral Fellows	15
	Research technicians	Not collected
	Administrative/support	11
	Research students	89
	TOTAL	**188**
Peer-reviewed research outputs by type	Books	0
	Book chapters	2
	Journal articles	232
	Invited conference/keynote presentations	33
	Prizes and distinctions	43-45
Commercial activities	Number of licences	Not collected
	Income from licences	Not collected
	Patent applications	Not collected
	Patents granted	-
	Invention disclosures	Not collected
	Spinouts	-
	Capitalisation value of spinouts	Not collected
Students studying at CoRE by level	Doctoral degree	76
	Other	13
	TOTAL	**89**
Number of students completing qualifications by category	Doctoral degree	7
	Master's degree	3
	Other	-
	TOTAL	**10**
Number of graduates by immediate post-study destination	Further study in NZ	1
	Further study overseas	-
	Employed in NZ in Māori organisation	-
	Employed in NZ other	5
	Employed overseas	4
	Unknown	-
	Other	-
	TOTAL	**10**

Peer-Reviewed Journal Articles

SCIENTIFIC PUBLICATIONS 2024

Abeywickrema, S., Ginieis, R., & Peng, M. (2024). Taste sensitivities mediate differential snack choices across BMI groups: A study with New Zealand young male individuals. *Obesity, 32*(8), 1453–1464.

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Athavale, O. N., Di Natale, M. R., Avci, R., Clark, A. R., Furness, J. B., Cheng, L. K., & Du, P. (2024). Mapping the rat gastric slow-wave conduction pathway: Bridging *in vitro* and *in vivo* methods, revealing a loosely coupled region in the distal stomach. *American Journal of Physiology-Gastrointestinal and Liver Physiology, 327*(2), G254–G266.

Aumasa, T., Apinanthanuwong, G., Singh, J., Kaur, L., Tian, J., Phongthai, S., Tanongkankit, Y., Issara, U., Ogawa, Y., & Donlao, N. (2024). White mulberry leaf (Morus alba L.) infusion as a strategy to reduce starch digestibility: The influence of particle size of leaf powder. *NFS Journal, 37*, 100196.

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Cree, J. M. E., Brennan, N. M., Poppitt, S. D., & Miles-Chan, J. L. (2024). The effect of the oral contraceptive pill on acute glycaemic response to an oral glucose bolus in healthy young women: A randomised crossover study. *Nutrients, 16*(20), 3490.

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De Bhowmick, G., Plouviez, M., Reis, M. G., Guieysse, B., Everett, D. W., Agnew, M. P., Maclean, P., & Thum, C. (2024). Evaluation of extraction techniques for recovery of microalgal lipids under different growth conditions. *ACS Omega, 9*(26), 27976–27986.

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