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Riddet Review

Riddet Institute
Food | Innovation | Health

Smart Foods: an opportunity for New Zealand

A Riddet Institute one-day workshop in February explored ways that New Zealand's food industry can take advantage of new opportunities presented by the digital age. On the menu were invisible kitchens, fridges that can communicate with supermarkets, and the food aspirations of millennials.

Workshop leader and Riddet Institute Principal Scientist Dr Mike Boland says, "Around 40 thought-leaders, policy and industry people accepted our invitation to start thinking now about what research strategies New Zealand could adopt. We have to start now or we will get left behind. At the moment, there is not a lot of co-ordinated research going on in New Zealand to address a changing population, and the future needs of people in an increasingly urbanised and digital world."

Two overseas speakers boosted an impressive line-up of those outlining current world trends in new behaviours. André Teixeira from Bundaberg Brewed Drinks in Australia and an Executive Professor at University of Antwerp, Belgium, and Nard Clabbers from TNO Healthy Living in the Netherlands, provided an international perspective.

What was clear at the workshop is that change is happening faster than many realise and will have profound implications for the food industry. The internet and digital devices will change how food is perceived, purchased and used by the consumer, and they have big implications for convenience, diet and health.

Leading supermarket Tesco "opened" its first virtual supermarket five years ago, in the subway in Seoul, and it is now the second biggest supermarket in Korea (under the "HomePlus" brand). Tesco also has a virtual supermarket at Gatwick Airport, and has developed a 3-D virtual reality supermarket that allows shopping

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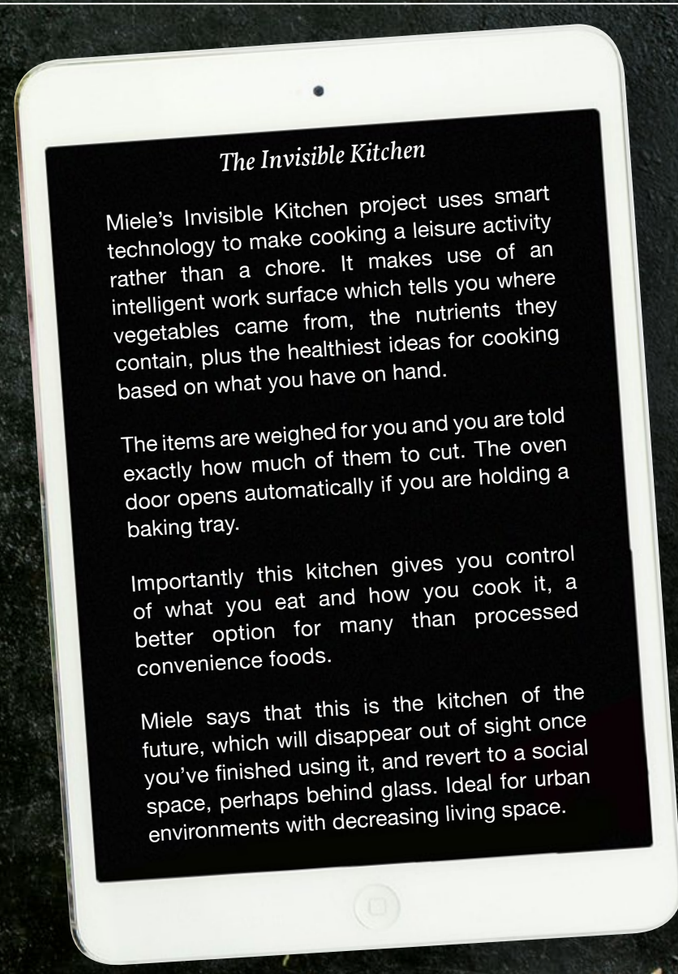
Smart Foods: an Opportunity for New Zealand continued

at home. Here in New Zealand, Countdown (Woolworths) has offered online shopping in some centres for 20 years and a smart phone app for this since 2012.

Food storage and ordering devices include, for example, smart refrigerators with cameras that 'know' what they contain and can resupply themselves online from the supermarket. The Samsung Family Hub refrigerator is an example, available locally throughout New Zealand, and it can interact with the Countdown online supermarket. Domino's are looking at pizza delivery using drones!

Customers, particularly younger people, are becoming increasingly aware of health-related aspects of food and diet. Personal devices (and even smart phones) are tracking levels of energy expenditure and other aspects of health, which can in turn provide advice about dietary needs.

Dr Boland says, "New Zealand is recognised as a smart producer of good, healthy food products. The new environment offers the possibility of an intimacy with the consumer never possible before. The nature of supply chains, value chains and labelling is going to change, and will offer new opportunities for our food industry and for brand "New Zealand". But only if we are prepared and take up the opportunity!"



Panel Visit Confirms the Institute's Progress and World Standing

A visit by the four members of the Riddet Institute Scientific Advisory Panel late last year resulted in encouraging comments about our research direction and effectiveness. The role of the Panel is to monitor the quality of our research and its fit with global scientific efforts in our chosen area.

Rickey Yada, Paul Ross, Alastair Robertson and Mark Wahlqvist.

The visit of the Panel, Professor Mark Wahlqvist, Chair, and three new members, Professors Alastair Robertson, Paul Ross and Rickey Yada, to the Riddet Institute was timed to coincide with the annual Student Colloquium (October 31 and November 1,2) held in Palmerston North. The Panel met before and after the event to discuss progress of the Riddet Institute and to prepare a full report on the Institute. All four members of the Panel attended the Colloquium each day and they themselves gave presentations.

The presentations were: How food and health systems intersect (Professor Wahlqvist); The role of food science in addressing food/ nutrition security (Professor Yada); Observations and experiences around outcome-focused multi-disciplinary research (Professor Robertson); and Microbes to Molecules: mining the microbiota for pharmabiotics (Professor Ross).

The Panel's report on the Institute was encouraging:

"It is clear that the Riddet Institute has a well-conceived integrated research programme in a highly relevant area of contemporary science. The cross cutting 'flagship' projects are a real strength and the research being undertaken is of very high quality."

"The SAP was also very impressed with the relationships which the Riddet Institute has built up with key stakeholders in recent years. These include both national and international food companies facilitated through Riddet Innovation…"

Our Purpose

The Riddet Institute brings together the top multi-disciplinary expertise in New Zealand that allows us to make an effective contribution to the advancement of knowledge in food science and nutrition.

This knowledge flows on to the food industry enabling it to develop innovative, healthier foods.

As a national Centre of Research Excellence we have the critical mass to have an impact internationally. We partner with the world's leading research organisations to advance knowledge in our area of expertise. The Riddet Institute is a showcase for New Zealand.

Proteos Project must be a Winner for New Zealand

The Proteos project, a global effort to assess protein value, presents a major opportunity for the New Zealand economy.

Central to the project has been the FAO's decision, based in no small part on Riddet Institute research, to change its standard for assessment of food protein quality. This standard underpins national food regulatory systems globally, and supports food product marketing. The change to a new standard will be significant for protein exporters in New Zealand and the dairy industry especially.

The switch from the FAO's current PDCAAS (Protein Digestibility-Corrected Amino Acid Score) standard, developed in 1991, to DIAAS (Digestible Indispensable Amino Acid Score), demonstrates for example the superior quality of dairy proteins when compared to other plant proteins (see figure below). The previous PDCAAS method was unable to differentiate the relative quality of dairy protein from soya protein whereas DIAAS demonstrates the higher nutritional value of dairy proteins.

When fully adopted by FAO and national regulatory bodies, DIAAS will allow marketers of foods containing dairy proteins to make claims of superior quality and thus nutritional value compared to plant-based proteins.

The Riddet Institute has been at the forefront of research on defining the nutritional value of food proteins, led by Distinguished Professor Paul Moughan. Determining the nutritional value of food proteins is technically difficult as proteins comprise differing combinations of individual amino acids - the elements which provide nutritional value through supporting protein synthesis. And there are challenges in measuring the net absorption of these amino acids into the body during the complex processes of digestion.

In 2011 Professor Moughan was invited by FAO to chair the international expert panel consultation on dietary protein quality evaluation in human nutrition. The panel recommended that individual amino acids be treated as distinct nutrients and listed separately, that PDCAAS be replaced by the DIAAS method, and that true ileal digestibility (digestibility of amino acids determined at the end of the small intestine) be the preferred measure of digestibility.

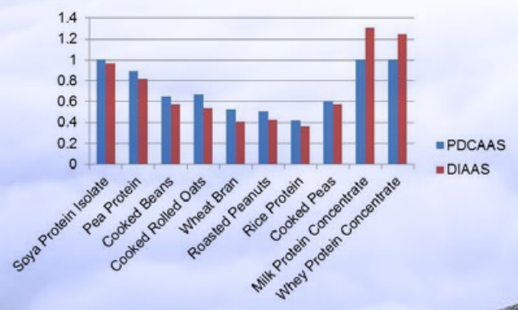
Globally, current consumption trends are towards plant-based food proteins. This is partly driven by the lower cost of plant proteins — soya proteins in particular — relative to dairy proteins (30 to 50% lower). For the dairy industry to reverse the current trend towards plant-based proteins, to capture a greater market share and to grow both margins and total sales it will need to be able to demonstrate greater nutritional value to overcome the cost disadvantage.

The Riddet Institute is heavily involved in a multinational programme to characterise the quality values of the world's food proteins using DIAAS and establish it as the gold standard for assessing dietary protein quality. The research is being funded by an international consortium of food industry sectors and is led by Professor Moughan.

The research will also support the emergence of the sheep and goat milk industries in New Zealand with their proteins likely to be shown to be of high nutritional value. It will also have an impact on addressing human health and global food security.

The Riddet Institute is heavily involved in a multinational programme to characterise the quality values of the world's food proteins using DIAAS.

PDCAAS and DIAAS Scores for Selected Protein Ingredients



Research Followed with Interest

A journal article by Riddet Institute Associate Investigator, Dr Lovedeep Kaur, was one of the top 30 most downloaded articles published in Food & Function 2016.

"High pressure Processing of meat: Effects on ultrastructure and protein digestibility" has been included in the Food & Function 2016 Most Accessed Articles Collection.*

Dr Kaur's research showed that the effects of high pressure processing on the ultrastructure and *in vitro* protein digestion of beef muscle meat caused a significant change in the visual appearance and texture of the meat at 600 MPa so that it appeared similar to cooked meat.

Dr Kaur says that the paper was focused on improving meat protein digestion. "It explores the application of a new and emerging technique, the high pressure processing of meat." This work was done in collaboration with researchers from a world class European research institution (INRA, France) and involved the use of cutting-edge microscopy and *in vitro* gastro-small intestinal digestion models.

"The downloading stats of the article reflect the considerable international attention paid by the researchers working in the area of meat processing."

"Our meat industry is looking forward to using new technologies such as high pressure and shock wave processing to improve the sensory and nutritional quality of meat, particularly low value meat cuts."

Dr Kaur has recently been awarded a financial grant from the Eric Ojala Sub-Trust to present her meat research at ICOMST to be held this year in Ireland.

"Development of highly processed meat products with greater health benefits is an opportunity for New Zealand to target both domestic and global export markets," she says.

*Other contributing authors: Astruc T, Vénien A, Loison O, Cui J, Irastorza M, Boland M.

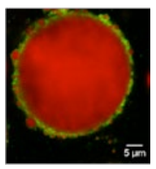
Best Presenters Highlighted at Student Colloquium in October

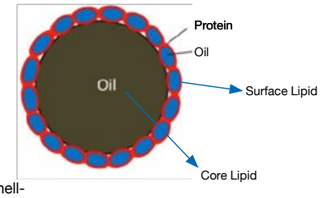
The Riddet Institute Scientific Advisory Panel (SAP) was particularly impressed with the standard of postgraduate students working at the Institute and their grasp of the scientific fundamentals underlying their areas of study.

"There was a high level of enthusiasm from both students and senior staff associated with the CoRE providing a sense of vibrancy. Throughout the two days of the Colloquium there was extremely good interaction and exchange between researchers and the feel of team play, and ample evidence of very high quality research programmes."

(Riddet Institute Scientific Advisory Panel)

Professor Giselle Byrnes and Sewuese Okubanjo





Nest droplets coated with shell-droplets observed with soyabean oil (triglyceride) as the core lipid

PhD scholar Sewuese Okubanjo received the Best Presentation Award at the Student Colloquium from Massey Assistant Vice-Chancellor Research, Academic & Enterprise, Professor Giselle Byrnes.

Ms Okubanjo's presentation on nested food emulsions highlights a new way of delivering bioactives that may provide a solution to the degradation and food incorporation challenges faced by four other well-known emulsion methods: single, double, multi-layered and Pickering emulsions.

Central to her research on nested emulsions is the theory that nested emulsions are stabilised by protein-coated shell lipid-droplets, which provide a unique structure.

Ms Okubanjo says, "Studying the impact of nested emulsions focuses on proving that they provide effective protection against degradation of bioactives incorporated within, and discovering their potential in food applications." Her three research questions are:

- How does varying the type of surface lipid and protein content of shell-droplets affect the final structure of 'nested' emulsions'?
- How does the physical state of surface lipid affect the oxidative stability of the core unsaturated lipids in nested emulsions?
- How does the physical state of surface lipid impact the location of antioxidants incorporated within the surface lipid of nested emulsions?

Ms Okubanjo is being supervised by Dr Simon Loveday, Distinguished Professor Harjinder Singh, Associate Professor Aiqian Ye and Professor Peter Wilde, Institute of Food Research, Norwich, England. She started her PhD in September 2015.

From Nigeria, Ms Okubanjo is a member of the Nigerian Institute of Food Science and Technology (NIFST) and of Graduate Women Manawatu.

Her research interests are focused on the design and development of foods that promote healthy eating and prevent certain diseases (functional foods) as well as designing delivery systems for functional ingredients. She has an Erasmus Mundus Joint European Master's Degree in Food Innovation and Product Design (FIPDes) from AgroParisTech, Dublin Institute of Technology and University of Naples Federico II.

Runner up
Syahmeer Muhammed How

Mr How is developing a mathematical model of the bolus formation during oral processing. In particular, he is trying to understand the interaction of food structure with saliva.

While there is a lot of literature on chewing models, no models have been shown to incorporate saliva addition, although saliva is proven to have an impact on certain foods such as foods with low moisture content and starch-containing foods. Mr How wishes to expand existing chewing models in the literature to account for saliva secretion to understand its impact on digestion, mixing, and taste and aroma release.

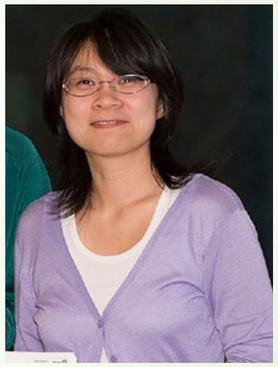
He says, "Understanding the impact of saliva during mastication is important to design foods that will be acceptable to consumers. For example, one of the most important roles of saliva in the mouth is starting the digestion of starches by means of salivary amylase. If a consumer wants a starch containing food product that has a prolonged sweetness perception in the mouth it is possible for food technologists to design this if factors that affect salivary amylase levels in saliva are fully understood."

Mr How is still in the early part of his PhD and is currently in the process of completing his conceptual models in order to start building on his mathematical model. He has also begun developing experimental methodologies focusing on the role and relevance of salivary amylase during oral processing. In the experiment, he simulates starch hydrolysis in the mouth by incubating saliva in gelatinised starch and measuring the reducing sugars produced after digestion.

Originally from Malaysia Mr How completed a BE (Hons) at Massey last year and commenced his PhD studies in May.

He is being supervised primarily by Riddet Institute Principal Investigator Professor John Bronlund.

Runner up
Xuejing (Ivy) Men



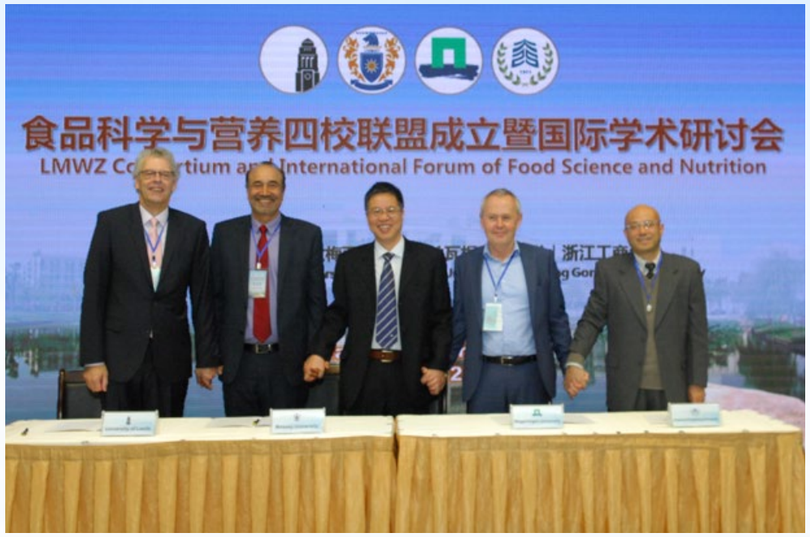
Ms Men started her PhD with AgResearch/Riddet in November 2013, and is now in her final year. She says, "Although NZ for me is by far an ideal place to live and work, I would also love to explore other parts of the world to look at new opportunities, and the excitement they bring."

Prior to her PhD, she graduated with an MSc in Human Nutrition at Massey's Institute of Food, Nutrition and Human Health, and her research work was conducted at AgResearch, with the Food Nutrition & Health Team.

Her research summary states: "Milk is known to be rich in nutrients and bioactive factors. Recent evidence has also shown the presence of a type of small molecule, called microRNA, in human and other mammalian milk. Since microRNAs regulate gene expression and are involved in a broad range of biological processes regarding human health, it is important to address the question of when we consume milk, do we consume these possibly functional molecules as well? So my research focuses on finding out the types and levels of microRNAs in milk, and some of their possible functional implications. It is also important to investigate how technological processes might alter milk microRNA levels for us to better understand the milk we drink!"

New International Consortium in Food Science and Nutrition Formed

Late last year, the Riddet Institute, through Massey University, signed a Memorandum of Understanding (MOU) with three other universities, creating a new international consortium in food science and nutrition.



Professor Mike Morgan, University of Leeds, Distinguished Professor Harjinder Singh, Massey University, Professor Dai Wenzhan, Zhejiang Gongshang University, Professor Kees de Graaf, Wageningen University, Professor Han Jianzhong, Zhejiang Gongshang University.

Massey University, University of Leeds, Wageningen University, and Zhejiang Gongshang University signed the MOU at Gongshang University in Hangzhou, China.

Distinguished Professor Harjinder Singh, co-director of Riddet Institute and Director of the Massey Institute of Food Science and Technology led the Massey delegation to China. Professor Matt Golding, Associate Professor Aiqian Ye, Dr Cathryn Conlon and Professor Manohar Garg (Honorary Professor, Riddet Institute) also attended.

Professor Singh said, “This international consortium will provide an excellent platform for our staff and students to enhance research capability and capacity at different universities. The combined expertise of the four highly ranked universities in food science will be attractive to the international food industry and will bring in new partnerships and funding.”

The MOU will provide a focal point for the preparation and administration of the Consortium for collaboration and co-operation including an avenue:

- To promote food science and nutrition research at the four universities in China, to both academic communities and industries
- To exchange and share the latest research developments in food science and nutrition research being carried out at the four universities
- To establish multi-lateral links and collaborations in research and student training programmes
- To establish a joint knowledge base for international food companies to access the Chinese market

Former Riddet Institute Chairman Dies

Dr Jim Watson, FRSNZ, former Chairman of the Riddet Institute from its inception in 2008 to 2015, died in February. His passing marks the loss of an iconic New Zealand scientist and leader, and the ‘founding father’ of New Zealand’s biotech industry.

Dr Watson’s passing is a great loss to science and innovation in New Zealand. I was privileged to work with Jim as a member of the Riddet Institute Centre of Research Excellence governance group and to experience his vision and leadership for high impact scientific research. A number of my colleagues also worked with Jim at different times during his illustrious career, and the inspiration he imparted to them and many other people was another of his significant contributions to the world of science.

Peter Landon-Lane
CEO, Plant & Food Research
(a Riddet Institute partner)

Dr Watson was a highly effective Chairman, not only respected by all for his ability in the field of science and science management and strategic thinking, but loved as a true friend and as a kind, approachable and generous human being.

Jim’s credentials were impeccable. He was a Past President of the Royal Society of New Zealand (2004-2006). He received a CNZM for services to scientific and medical research in 2006. He founded and was former CEO of Genesis Research and Development, and past Chair of the National Science Panel. He had a long career in health sciences that included professorships in immunology at the University of California, Irvine, and the University of Auckland, where he was head of the Department of Molecular Medicine from 1983 to 1994. Among his directorships was his role on the Board of the Foundation for Research, Science and Technology, from 1999 to 2002.

Dr Watson had entrepreneurial skills and had many contacts in the global science network. He co-founded Genesis in 1994, which was really New Zealand’s first biotech company of any significance. In 2004, he founded BioJoule Limited, a renewable energy company and a subsidiary of Genesis. He was Managing Director of BioJoule until its sale to Pure Power Global in 2007.

Later he founded Caldera Health, together with fellow prostate cancer sufferer Dr Richard Forster. The company’s goal is to develop a new, less intrusive, and more reliable global standard for diagnosing prostate cancer, using next-generation gene sequencing technology. It continues his vision today.

With Jim’s passing, the Riddet Institute has lost a great supporter and advocate.

Deputy Director Settles in

Professor Warren McNabb, was appointed Deputy Director of the Riddet Institute in October last year. Professor McNabb has been a Principal Investigator with the institute since 2008, and was based at AgResearch as the Research Director.

Professor McNabb joined AgResearch in 1993 and his research focused on nutrigenomics and nutritional epigenetics, food-host microbial interactions and food for human health and well-being.

He is a Fellow of the New Zealand Institute of Agricultural and Horticultural Sciences and has authored more than 200 publications.

In Brief

Professor Gang Pei, President, Tongji University, has been appointed an Honorary Professor within the Riddet Institute.

Professor Merryn Gott (Riddet Institute Board member) was the NEXT Woman of the Year winner in the Health and Science category.

Dr Skelte Anema (Riddet Institute Affiliated Researcher) was elected a Fellow of the Royal Society of New Zealand.

Four Riddet Institute students have completed their PhDs: (left to right) Lakshmi Acharya, Eva Maier, Christiane Schmidmeier, Natascha Ströbinger.

Distinguished Professor Harjinder Singh was honoured as a Distinguished Alumnus at a meeting of the Association of Basic Sciences & Humanities Alumni, Punjab Agricultural University, India. He was also recently appointed to an Adjunct Professor position at the National Dairy Research Institute, Karnal, India.

Award for Chairman

Dr Kevin Marshall, Riddet Institute Chairman, was presented with the prestigious IDF (International Dairy Federation) Award 2016 in December. He was one of three nominees to receive the award, alongside Dr Paul Jelen (USA) and Dr Phil Kelly (Ireland).

Dr Marshall's citation read: Dr Marshall has made a truly outstanding contribution to the global dairy industry and broader food sector, which he continues through to the present day as Chairman of the Riddet Institute – the Centre of Research Excellence in Food Science and Technology in New Zealand, as Chairman of the Industry Advisory Panel for the New Zealand High Value Nutrition National Science Challenge and as Chairman of the New Zealand Food Safety Science and Research Centre. In addition Dr Marshall is or has been a director on a wide range of other food and primary industry boards.

His outstanding contribution to the IDF included numerous science, technical, governance and leadership roles.

OUR PARTNERS

A partnership approach is central to our vision. The Riddet Institute brings together leading scientists from Massey University (host institution), the University of Otago, The University of Auckland, AgResearch and Plant & Food Research.

Riddet Institute
KAI | WHAKAAUAHA | HAUORA

agresearch

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

UNIVERSITY OF OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND

SYMPOSIUM

7th International Symposium on Delivery of Functionality in Complex Food Systems

Auckland, New Zealand
5th-8th November 2017

Riddet Institute
Food | Innovation | Health

www.dof2017.org

The DOF2017 symposium will be the primary platform for presenting new scientific developments in complex food systems, and their applications to food engineering design, food functionality and food consumption, the concepts of complexity and emergent phenomena in food science and two new topics: replacements for animal-derived proteins; and effects of food structures on the microbiome of the human gut.

The proposed topics for the scientific sessions are:

- Novel structures for delivery of bioactives in foods
- New and emerging processes and ingredients for delivering functionality
- Natural and biomimetic food systems – structures and functionality
- Food synergy to deliver enhanced functionality
- Delivery to the microbiome
- Implementation of delivery systems in food products
- Complexity and emergent phenomena in food science
- Interactions between delivery systems and the human body (sensory, digestion, release, bioaccessibility and bioavailability)
- Functionality of animal-derived proteins and their substitutes and extenders

CONFERENCE

The fourth international Food Structures, Digestion and Health (FSDH) conference, is being held in Sydney on 24-27 October.

More details are on the conference website:
www.foodstructuresdigestionandhealth2017.com/

The conference is hosted in turn by the Riddet Institute and CSIRO.

CONFERENCE

The annual NZIFST conference is being held in Nelson from 4 to 6 July.

Dr Mike Boland will lead a session relating to Riddet Institute research, which will feature some of the Institute's top students.