



# NZIFST Conference 2023

## SPEAKER ABSTRACTS

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## PLENARY A

### **Speaker A1 Lain Jaeger**

Affiliation Former Chair, Primary Sector Council

*Paper Title The New Zealand Food Sector - the New Normal*

#### **Abstract**

Countries around the world are implementing far reaching industrial policies as they seek competitive advantage while decarbonising their economies in the context of rapid geopolitical, consumer, climate, environmental and technological change.

On the face of it two sectors in the New Zealand economy are candidates for active industry policy; the energy sector as we seek to double renewable electricity production and to become energy independent, and the Food and Fibre sector as we seek to simultaneously drive growth and decarbonise our export economy.

This presentation characterises both the challenges and opportunities ahead of the New Zealand Food and Fibre sector in the global context at a time of unprecedented change for the New Zealand economy

### **Speaker A2**

**Brett Cowan**

Affiliation

Chief Scientist, ESR

*Paper Title*

*Misinformation / Disinformation*

#### **Abstract**

Our world is soaked with information, some of which even turns out to be true.

Mis-information and dis-information have always been with us, but can now be created and delivered at unprecedented scale. We have seen this with COVID-19, politics, and on social media, and the world is struggling to respond in a way that balances freedom of speech, and the distribution of damaging content. It is not always clear why some people believe things that others consider inconceivable, and we will consider some of the reasons for this.

This talk will take us on a journey through artificial intelligence, psychiatry, law, and science to see what these disparate domains have to teach us about the shadowy world beyond truth, in consideration of misinformation, dis-information, and lies.

Brett has a background in philosophy, ethics and data science and will merge these together to challenge some of our preconceptions.

## Session B1 Dairy Matters

**Speaker B1-1**      **Abby Thompson**  
Affiliation          Miruku  
Paper Title          *Plant Grown Dairy?*

### **Abstract**

New Zealand start-up Miruku ([www.miruku.com](http://www.miruku.com)) is one of a small number of companies globally who are planning to use plants to produce proteins and fats similar in structure to those present in bovine milk.

The idea of transforming plants to produce valuable proteins is not new. It is more than 30 years since scientists first produced recombinant human proteins in transgenic plants. However, what is relatively new is the idea of using plants to produce recombinant proteins at large scale as part of a more sustainable food system.

This presentation will provide an overview of the following:

- What is molecular farming?
- How does molecular farming compare with other protein production technologies (including precision fermentation)?
- Who are the key global molecular farming companies and what are their approaches?
- Why is Miruku developing a new category of functional food ingredients containing a mix of plant and dairy-inspired proteins and fats?
- How does Miruku plan to commercialise these ingredients?

**Speaker B1-2 Marlon dos Reis**  
Affiliation      Scientist, AgResearch  
Paper Title      *Hyperspectral imaging through vacuum packaging to assess biochemical changes in cheese*

Authors: Marlon M Reis, Yash Dixit, Alistair Carr, Christine Tu, Faith Palevich, Tanushree Gupta and Mariza G Reis

AgResearch Limited, Te Ohu Rangahau Kai, Massey University, Palmerston North, 4474, New Zealand

### **Abstract**

Hyperspectral imaging (HSI) combines imaging with spectroscopy, where a spectrum is collected for each pixel in a scanned area. HSI has been demonstrated to detect the major biochemical changes in cheese during ripening (e.g. proteolysis and lipolysis). In this study, we explored the ability of HSI to monitor biochemical transformation associated with the presence of spore-forming bacteria. Spore-forming bacteria are an important group of spoilage microbiota in dairy products. Bacterial spores are resistant to different environmental conditions, which in turn allows them to survive food-processing treatments. Moreover, spores are widely distributed in nature, offering multiple points of entry into the dairy system. The contamination of milk with endospores of butyric acid-producing Clostridia represents a major concern for cheese producers around the world, as they

spoil cheese production leading to significant economic impact. In this study a novel method for monitoring cheese contamination with *Clostridium* spores non-invasively using hyperspectral imaging (HSI) is described. The ability of HSI to quantify *Clostridium* metabolites was investigated with control cheese and cheese manufactured with milk contaminated with *Clostridium tyrobutyricum*, *Clostridium butyricum* and *Clostridium sporogenes* identified previously in NZ milk. Microbial count, HSI and SPME-GC-MS data were obtained over 10 weeks of storage. The abundance of twenty-nine volatile metabolites were monitored across the storage period to investigate biochemical transformation across the treatments. Funding: "Food Integrity" – project (No. PRJ0126328) funded by the MBIE/NZ through the AgResearch Strategic Science Investment Fund.

**Speaker B1-3**      **Don Otter**  
Affiliation          Consultant  
*Paper Title*        *Has a2 Milk taken over NZ?*

**Abstract**

What milk is 'best' for us? The purported health benefits of A2 milk (or the detrimental effects of A1 milk) were first floated in the 1990's after epidemiological research by Bob Elliott at the University of Auckland. A2 represents a  $\beta$ -casein genetic variant which contains a single amino acid change to the  $\beta$ -casein A1 variant. The ratio of A1:A2 is typically 50:50 in Holstein/Friesian cows, the most common New Zealand dairy breed. Since that time a thriving dairy market in A2 milk has evolved in Australia (~10% of liquid sales) and in the Chinese infant formula market. Surely then, it is a no-brainer to convert the New Zealand dairy herd to A2 cows? If so, how has the A1:A2 ratio in commercial milk changed in the intervening 25 years? Samples of commercial milk were sourced from supermarkets and retail outlets throughout New Zealand. The ratio of A1 and A2  $\beta$ -casein was determined by high performance liquid chromatography and high resolution mass spectrometry. Overall a shift in the  $\beta$ -casein A1:A2 ratio from 50:50 to 30:70 was observed in the milk samples. Is this good or bad? The drivers for change within the dairy industry are reflected in comments elicited from a range of dairy farmers. This study provides insights into the New Zealand commercial milk market and the attitudes of milk producers and manufacturers.

**Speaker B1-4**      **Loc Pam**  
Affiliation:          Fluid Air  
*Paper Title*        *Low temp electrostatic spray drying*

**Abstract:**

Electrostatic spray drying (ESD) is an innovative technology combining gas-liquid atomisation and electrostatic charge. Unlike traditional high-heat spray drying (SD), low voltage is applied during atomisation and the product temperature is maintained below 40oC. ESD and traditional SD were used to dry milk, infant formula, colostrum and lactoferrin. ESD powders had large, highly agglomerated structures assembled by the agglomeration of small primary particles (<20  $\mu$ m) with an average water activity of 0.20 and

residual moisture below 4%. The surface chemistry of ESD powders was modified by the electrostatic charge (5-10 kV) and milk based ESD powders had approximately 8-10% lower surface fat compared to SD powders. Nitrogen is used as the drying gas and the peroxide value was reduced by ~40% during storage. Heat induced browning reactions (measured as HMF content) were also reduced by approximately 30% in ESD powders. The biological activity of active lactoferrin and immunoglobulins was greater in ESD powders with significant losses in the order of 10-20% measured after high-heat SD. Implemented commercially, the novel approach of electrostatic spray drying was recently adopted in the Americas, Asia and Australia for its proven capacity to prevent thermal degradation of heat sensitive materials.

## Session B2 Challenges and opportunities in the Agri-food sector

### Speaker B2-1

**Craig Bunt**

Affiliation

University of Otago

Paper Title

*Bridging Gaps: encouraging agriculturalists and food scientists to embrace innovation*

### Abstract

This abstract serves as a call to action, urging agriculturalists and food scientists to collaborate and explore the potential transfer of knowledge and practices from food manufacturing and processing settings to on-farm operations. By fostering this cross-pollination of ideas, we can effectively tackle the pressing issue of food waste within the agricultural industry.

Drawing upon the expertise of food scientists, agriculturalists can gain valuable insights into innovative technologies, packaging solutions, and quality control measures employed in manufacturing and processing environments. Implementing these practices on the farm can significantly reduce post-harvest losses, enhance product freshness, and extend shelf life. Additionally, food science-driven research can offer valuable guidance on crop management, disease prevention, and yield optimization, mitigating potential losses at the source.

By embracing this call for collaboration, agriculturalists and food scientists have the opportunity to revolutionize on-farm practices, creating a more sustainable and efficient food system. Through joint efforts, we can develop integrated solutions that minimize food waste, ensure resource efficiency, and contribute to a resilient agricultural sector. Together, let us bridge the gap and unlock the full potential of on-farm innovation for a brighter, more sustainable future.

### Speaker B2-2

**Tara Dwyer**

Affiliation

Headwaters

Paper Title

*Lumina: An overnight success, 13 years in the making*

### Abstract

Headwaters NZ is a collective of progressive, innovative farmers from around the country who produce lamb to be marketed under the label 'Lumina'. A combination of genetics and special finishing diet means this lamb is the most sought after in the world, it provides a remarkable eating experience that is unlike any other lamb product. Lumina operates on a fully transparent value chain, where farmers are directly connected to the end consumer, and vice versa.

Ever evolving consumer demands require New Zealand farmers to be thinking a decade ahead to ensure that what is being produced matches what is being sought from market. By moving their red meat products off the commodity cycle and achieving better, more stable returns, our farmers are able to focus their investments and time where they matter most: promoting

native biodiversity to thrive, taking steps to reduce net emissions and nurturing strong community relationships.

**Speaker B2-3**      **David Cole**  
Affiliation          Mt Cook Salmon  
Paper Title        *Challenges and Opportunities in Aquaculture - a Salmon sector perspective*

**Abstract**

The future of work, the planet, inequality, inflation, supply chain disruption, AI and even global peace - have never posed a greater threat to all of us. We're at a junction where past business models may not be a beacon for future success. And we will need to be vigilant and nimble to navigate through the future fog if we are to preserve our competitive advantage in this rapidly changing landscape.

For the salmon sector in New Zealand, this is particularly so. We are small on a global scale, but significant exporters for NZ Inc, and have learned to compete successfully in tough international markets.

But if we are to prosper further, we will have to find ways to exploit our niche strategies; to negate the carbon distance from markets; and go beyond relying on our provenance.

This is our focus.

**Speaker B2-4**      **Jody and Blair Drystale**  
Affiliation          Hopefield Hemp  
Paper Title        *Hemp: Growing a "health" future*

**Abstract**

Though the course of our farming career we had a desire for adding value to the crops we can grow on our property. We decided on Industrial Hemp because of the niche opportunities that allowed us to grow a crop that is healthy for the Soil, Environment and People.



## Session B3 Nutritional quality of plant based foods

**Speaker B3-1**      **Anneline Padayachee**

Affiliation              Expert

*Paper Title*              *Protein is the New Black - nutritional quality is just as important as quantity*

### **Abstract**

Protein is the basis for every strand of DNA to the marketing messaging on sports shakes and diet bars. Out of all the macromolecules, protein is the one with the “least” negativity, for now at least. Hence it is important to learn the lessons from the anti-fat and I Quit Sugar eras between 1980-2010s. There is no doubt protein is both essential as a nutrient in dietary intake, as well as a nutrient in bodily functions. However not all proteins are the same. Not all proteins are equal. And not all protein-rich foods have the same impact on health. And in general foods do not contain protein in isolation all alone. The rise of protein-alternatives provides scope for novel food developments, improving product diversity for consumers, is inclusive of those on a plant-exclusive diet. However we cannot forget that we eat food, not individual nutrients. Whole foods are a source of proteins in addition to other nutrient compounds. Hence when designing protein rich foods, derived from plants or animals, nutrient quality in terms of bioaccessibility and bioavailability have to be assessed as well. It is not good enough to focus on quantity anymore. We have to consider digestibility and absorptive factors as well. In truth we need more protein-rich foods to minimise malnutrition globally. Not everyone has access to animal-derived foods. The alternative protein sector only have one chance to get this right any negative health outcomes in the future will have a major impact on the success and growth of the alternative protein sector. Hence it is essential to understand proteins in terms of it's nutritional quality, digestibility, absorption, and factors that enhance or detract from bioavailability.

**Speaker B3-2**      **Gert-Jan Moggre (PFR)**

Affiliation              Plant & Food Research

*Paper Title*              *Technology development for barley based plant based foods*

Authors Carl Massarotto\*, Gert-Jan Moggré\*, Andy Hay, Irene Ho, Katrina Fletcher, Thomas Sowersby, Sandi Keenan, Sarah Roberts.

### **Abstract**

Plant & Food Research is a New Zealand Crown Research Institute with a long history of both breeding new plant varieties and developing new food technologies. We will discuss how we have brought together both these R&D capabilities with commercial endpoints in mind. Some of the varieties we have bred and commercialised earn us significant royalties, some of which are being reinvested into developing new technologies to support food & beverage innovation, in the hope of growing our royalty base. In line with this strategy, we are bringing together our capability in breeding lead

cultivars with our experience and expertise in food formulation to develop a stack of technologies that we hope serves opportunities in the plant-based foods market. We will discuss a new, scalable barley variety with elevated concentrations of beta-glucan; plant-based milk formulations and processes based on beta-glucan barley; and methods for producing plant-based yoghurt formulations on beta-glucan barley. We are showcasing this technology stack at NZIFST to determine if other New Zealand R&D researchers are keen to collaborate with us, to test our consumer value proposition, and to gauge potential interest in joint commercialisation of plant-based products.

**Speaker B3-3**      **Jaspreet Singh**  
Affiliation          Massey University  
*Paper Title*          *Potential of NZ grown pea varieties for developing low glycaemic foods*

Authors: Abayomi Ajala, Lovedeep Kaur, Sung Jee Lee, Jaspreet Singh\*  
(\*Presenting Author)

**Abstract**

Our study reveals how the microstructure of New Zealand pea varieties: White/yellow (WP), Marrowfat (MFP), Blue (BP), and Maple (MP) respond to pre-and-post starch gelatin ation conditions. The microstructural characteristics of raw pea seeds and in-vitro oral-gastro small intestinal starch digestion behaviour of the cooked pea seeds (post-starch gelatinization condition) were studied. For the raw seeds, the thickness of the cell wall for the pea varieties differed significantly from each other and followed a decreasing order of MP > MFP > BP > WP. The highest average number of starch granules per cell was found in MFP (12.0/cell). The shortest time (139 min) for the soaked pea to reach its saturation point was exhibited by BP at 60 °C while the lowest moisture content of soaked peas at saturation point was found in MP at 60 °C (89.92% d.b). The starch hydrolysis (%) of the cooked pea varieties during oral-gastro-intestinal digestion in vitro fall between the range of 18.2–27.6% and followed a decreasing order of WP > MP > MFP > BP. The estimated glycaemic index (eGI) was thus lowest for BP (47.5%). The number of starch granules per cell and fibre content was correlated positively ( $p \leq 0.01$ ) with the starch hydrolysis of the pea varieties. The discernible irregular particles (protein bodies, fibre fragments) attached to or between the starch granules observed in both hydrated and cooked pea seed microstructure seemed to modulate the inflow of water and starch digesting enzymes.

**Speaker B3-4**      **Nicola Wilson**  
Affiliation          Leaft Foods Ltd  
*Paper Title*          *A comparative look at in vitro protein digestibility*

**Abstract**

Leaft Foods purpose is to reduce the environmental impact of food production though partnering with farmers to produce sustainable and environmentally friendly protein for human consumption. Leaft are presently

expanding their team of food technologists and scientists to create ingredients and formulations with protein from leaves, to unlock new food choices and new nutrition offerings.

Globally food manufacturers creating plant based foods manipulate flavours, textures and microstructures primarily to optimise sensory and functionality. Nutrition remains the third cab off the rank. Constrained by the impact of protein on texture, taste and functionality, how can these food matrices deliver protein nutrition in quantity and quality? Leaft Foods is working with nutrition experts to understand the role of leaf protein in nutrition. How does Leaft foods proprietary leaf protein compare with other protein sources? Invitro digestion studies have been completed in collaboration with Dr Lovedeep Kaur and associates at the Riddet Institute.

## Session B4 Sensory and Flavour

<b>Speaker B4-1</b>	<b>Biniam Kebede</b>
Affiliation	University of Otago
Paper Title	<i>Advanced analytical fingerprinting tools to tackle flavour-related challenges</i>
Authors	Biniam Kebede, Indrawati Oey, Graham Eyres, Phil Bremer

### Abstract

Food flavour development derives from complex (bio)chemical reactions that depend on numerous intrinsic and extrinsic factors. Understanding the development of volatile flavour compounds during processing and subsequent storage will help reduce production costs and facilitate quality improvements. This talk summarises several food industry-related projects where GC-MS-based fingerprinting and multivariate data analysis were used to increase our understanding of the complex changes during the flavour development of foods. The first project investigated the effect of industrial processing stages (kilning, cutting, steaming, rolling and packaging) on the enzymes, lipids and volatiles of wholegrain and rolled oats. This was conducted in collaboration with Harraway & Sons Ltd and supported by Callaghan Innovation. In partnership with Whitestone Cheese, the other project obtained insight into developing volatiles in blue cheeses during ripening. These industry projects demonstrated that advanced bio-sensors and data analysis approaches have a huge potential to monitor, control and predict complex (non)linear biochemical changes during the processing and storage of foods in the food industry.

<b>Speaker B4-2</b>	<b>Damir Torrico</b>
Affiliation	University of Otago
Paper Title	<i>Understanding the relationship between flavor/aroma characters of New Zealand Pinot noir wines and their chemical volatile composition using Regression Tree Supervised Machine Learning</i>

### Abstract

Pinot noir (PN) wines have complex sensorial profiles. In New Zealand (NZ), regional differences significantly affect wine's sensory characteristics. Flavor/aroma characters are linked to volatile composition, but precise relationships are not entirely understood. This study aimed to investigate the relationship between flavor/aroma characters and volatile composition of NZ PN wines using regression tree supervised machine learning. Ten NZ PN wines (selected based on region: Central Otago, Marlborough, North-Canterbury, and Waitai, and vintage: 2015-2019) were obtained commercially. Descriptive analysis (N=10, trained) was used to characterize flavor/aroma using an unstructured line intensity-scale (0=Absent-10=Extremely strong). Physico-chemical analyses included titratable acidity (3.46-3.64g/L), pH (6.66-8.08), tannins (469.42-1471.63  $\mu$  g/ml), and total

phenolics (20.97-54.90AU). Aromatic volatiles were measured using Headspace-Solid Phase Microextraction (HS-SPME) with Gas Chromatography-Mass Spectrometry (GC-MS, QP-2010). Data were analyzed using ANOVA, correlation analysis ( $\alpha=0.05$ ), and regression tree supervised machine learning (RTSML), modeling sensory characters based on aromatic volatiles. Results showed that all wines had varying levels of 'cranberry' (3.25-6.29), 'cherry' (2.45-4.33), 'floral' (1.67-5.43), 'black currant' (1.74-4.96), and 'oak' (2.77-5.28). All wines were considered high in 'acidity' (5.18-9.04) and 'astringency' (5.51-8.93). Regional effects were only present for 'body', in which Central Otago wines had higher values compared to the others (6.07 vs. 2.99-5.74). RTSML showed that 'cranberry' maximized its expression in NZ PN when phenethyl alcohol > 28260.00  $\mu\text{g/L}$  and octanoic acid  $\leq 1558.37 \mu\text{g/L}$ . Similarly, 'floral' had a higher expression when sec-butylmethoxypyrazine  $\leq 0.02 \text{ng/L}$  and benzaldehyde > 50.92  $\mu\text{g/L}$ , 'capsicum' when ethyl lactate > 242705.00  $\mu\text{g/L}$ , and 'green/herbaceous' when butanoic acid  $\leq 1192.13 \mu\text{g/L}$  and benzaldehyde > 50.92  $\mu\text{g/L}$ . Correlation analysis showed that phenethyl alcohol was positively correlated with 'cranberry' and 'raspberry' (0.84-0.88), isobutyric acid was positively correlated with 'cherry' (0.83), and ethyl isobutyrate was positively correlated with 'capsicum' (0.75). The findings of this study will be useful in improving the relationships of aromatic compounds with sensory characters in PN wines by using novel decision tree algorithms.

**Speaker B4-3**

Affiliation

Paper Title

**Mei Peng**

University of Otago

*Effects of olfactory and gustatory perception on food choices and macronutrient intake*

**Abstract**

Individual dietary choices have an important role underpinning nutrition-related health status, unravelling factors influencing such behaviour thus represents an ongoing key research question. Chemosensory function is often regarded as a gatekeeper for dietary choices and intake, however empirical findings of such sensory-diet links remain highly controversial. I will present our recent findings based on a series of empirical studies with the aim to uncover chemosensory links to dietary choices and intake (comprising datasets from 4 experiments, with 2 new studies unpublished yet). We systematically addressed a few important questions using sound psychophysical methods (e.g., signal detection theory), cognitive and neuroimaging techniques, including [1] roles of olfactory and gustatory supra-threshold sensitivities on daily energy intake (Study 1; N=98); [2] relationships between individual chemosensory perception and dietary macronutrient composition (Study 2 & 3; N>212); [3] sensory drivers to food choices based on taste quality profiling (Study 4; N=130). In summary, our results reveal that individual olfactory and gustatory supra-threshold sensitivities can explain considerable variations in food choices, however only gustatory sensitivities can be directly linked to macronutrient intakes. Further, profiling food choices based on taste qualities (rather than by energy or nutrient) helped to resolve the mechanism underpinning

sensory effects on dietary behaviours. Further the results revealed significant relationships between sensory clusters and taste quality preferences ( $\beta = 0.41$ ,  $p = 0.008$ )

Overall, I will present exciting new evidence for differential roles of olfactory and gustatory senses in informing and modulating individual food choices, highlighting possible action of a sensory-mediated mechanism guiding food choices.

**Speaker B4-4**

**Pat Silcock**

Affiliation

University of Otago

Paper Title

*Never work with animals or children, actually children are not that bad*

**Abstract**

W.C. Fields coined the phrase 'never work with children or animals' in entertainment and it also generally holds for sensory scientists. However, due to differences sensory perception as well other factors common among children like food neophobia, pickiness and fussiness and more limited food familiarity, children's preferences cannot be assumed to be the same as adults. Assessing of children's food preferences is further complicated by differences in their language abilities and developmental stages. We have been investigating liking of snack foods in 5 - 8 year olds age group. This talk will cover our approach for information sheets, designing the task and explaining the task to the children. Preliminary data will be presented showing scale use and children's ability to identify differences in liking between product prototypes.

## PLENARY C Food Integrity, Security and Circularity

**Speaker C1**                      **Mike Casey**  
Affiliation                      New Zealand Zero  
*Paper Title*                      *Electrifying Everything*

### **Abstract**

When Mike Casey, tech entrepreneur, decided to get into farming, he had no idea what he was in for. Maybe that's why he was willing to set the ambitious goal of creating the world's first 100% zero fossil-fuel farm. In this vulnerable and transparent talk, he'll walk us through what worked, what didn't, how much it all cost, and whether it was worthwhile in the hope that your next purchasing decision for your home, business or farm is electric.

**Speaker C2**                      **Craig Armstrong**  
Affiliation                      NZ Trade and Enterprise  
*Paper Title*                      *New Zealand's national and international economy as it relates to our food security*

### **Abstract**

Food security is increasingly a pressing issue in NZ, and a critical global concern affecting millions around the world. It is a complex topic encompassing agriculture, manufacturing, logistics, policy and accessibility. New Zealand, as an agrifood powerhouse, could play a significant role in learning of, and in addressing this issue. This presentation explores food security in New Zealand and selected international examples, focusing on some of the decisions and operational practices, and the environmental, social and governance (ESG) factors that influence it; and what is being and could be done to guard against it. By considering business and economic models, and the environmental impact, social equity and responsible governance within the food system, we can develop strategies to ensure a sustainable and resilient food future at a local, regional and global level.

## Session D1 Aspects of Food Circularity

**Speaker D1-1**      **Campbell Ellison**  
Affiliation            Callaghan Innovation  
*Paper Title*            *High value products from horticultural by-products*

### **Abstract**

There are huge quantities of by-products generated from the primary processing of horticultural products. In many cases, these by-products contain significantly more beneficial compounds for nutrition or wellness than the target product. Through Bioresource Processing Alliance (BPA)-funded projects, these by-products have been converted into extracts, ingredients and food products for NZ companies that range in value from \$10-\$1000/kg whilst also utilising the large volume streams. Seeds produced through processing of vegetables generally contain high levels of fat and protein and can be separated into these two fractions by solvent or near-critical extraction. The oils can be utilized as food or cosmeceutical ingredients and the protein can be used as a powder or in plant milk and meat replacement formulations. Fruit and vegetable peel by-products from juicing operations are quite often are rich sources of sugars and phenolics with powerful antioxidant capacity. The peels can be screw pressed and polyphenols can be recovered from press liquor or hot water/ethanol extraction of press cakes and then purified by resin adsorption or membrane processing. Pectin can be extracted from a variety of peels or pomace through enzymatic or acid hydrolysis. Insoluble fibre pulp can be converted into the base for sorbet or dried to make crackers or powders.

**Speaker D1-2**      **Jocelyn Eason**  
Affiliation            Plant & Food Research  
*Paper Title*            *Black Soldier Fly - insights into insect bioconversion to value-add organic wastes*

### **Abstract**

Bioconversion systems have the potential to create new economic opportunities in New Zealand and contribute to the development of a circular economy, where waste is treated as a valuable resource rather than a burden.

Bioconversion is the process that turns undervalued organic products (e.g., horticultural waste, food processing byproducts) into value-added products (e.g., functional animal feeds). Insect-based bioconversion technologies are currently focused on the black soldier fly (BSF, *Hermetia illucens*). Globally, BSF-based bioconversion enterprises are being built to help manage waste streams and generate revenue from sales of BSF derived products.

BSF larvae consume a wide range of organic wastes and convert them into high-quality protein and fat-rich biomass, which can be used as animal feed, fertilizer, or even as a biofuel. While BSF larvae can eat almost any organic products, their use as an animal feed requires that they develop biomass



with suitable nutritional composition, and that their biomass can be processed into desired products for the target animals. The successful application of BSF-based bioconversion technology in New Zealand and overseas (e.g., Singapore, Cambodia, Pacific Islands) requires further research to optimise bioconversion efficiency and the quality of the converted products. This is a key research area for our team. We will share our approach for optimizing the BSF-based bioconversion system to de-risk the application of BSF as a bioconversion technology for Aotearoa.

**Speaker D1-3**

**Owen Catchpole**

Affiliation

Callaghan Innovation

Paper Title

*High value products from process grade avocados*

**Abstract**

Avocados are a high value horticultural crop grown from the Bay of Plenty through to Northland. The avocado industry has ambition to grow to a \$ 1B/pa industry by 2040. Around 10 % of the crop is deemed to be process grade, unsuitable for direct sale as a ready to eat fruit but suitable for generating avocado oil or puree-based products. Here, we discuss the development of both a freeze-dried avocado flesh powder; and a polyphenol-rich antioxidant prototype product derived from avocado peel. The flesh powder is derived from a processing line giving puree, which is then frozen and freeze-dried. Peels and stones by-products from the processing. The powder has been successfully trialled as an ingredient across a variety of food formats and processing systems and is commercially available to F&B manufacturers. Its 70 % oil content makes it popular as a nutritionally dense energy food, even where it is helping power a team of explorers attempting to become the first to ski across Antarctica unsupported. The skins of avocados contains phenolics with a range of molecular weights encompassing chlorogenic acids, glycosylated quercetin-type flavonoids, and various oligomeric procyanidins. An organic solvent-free process has been developed to extract the phenolics from the skin by-product and partially separate them from avocado 'sugars', mainly mannoheptulose and perseitol, and other compounds. The prototype antioxidant has been tested in standard ABTS and DPPH antioxidant assays and also in oils using an Oxitest™ apparatus and found to have similar activity to Trolox™, a water-soluble analogue of tocopherols.

**Speaker D1-4**

**Saskia van der Geest**

Affiliation

Consultant

Paper Title

*Food in a changing world. How will that change your role?*

**Abstract**

The next wave of innovation is coming. The wave is driven by the changes our planet it facing. Phrases like System thinking, Biomimicry, Designing for the Circular Economy, Remanufacturing, Food resilience, etc. will become our new jargon.

Are you ready for it? How will it change your role? Your organisation? Have you thought about how you and your organisation can make the most of the opportunities the new wave offers? How you could be leading? Wondering where to start? Come join this session and learn about the trends, pick up ideas and possible directions. Get a feel for where the opportunities might be for your organisation. And how you can be a valuable partner in those conversations. There are some brilliant opportunities in this, some awesome innovations. IF you're willing to grab them!

## Session D2 Innovation in food processing

### Speaker D2-1

**Lemuel Diamante**

Affiliation

Seperex

Paper Title

*Vacuum Frying below the triple point of water (VFBTPW) of frozen unmarinated beef slices*

### Abstract

A study was conducted on vacuum frying below the triple point of water (VFBTPW) of frozen unmarinated beef slices with different frying times (5-45 minutes), determined the various physicochemical properties of the resulting dried products, compared the physicochemical properties of VFBTPW dried and freeze-dried (FD) products and evaluated the structure of the VF and FD beef slices using the scanning electron microscope (SEM).

Using 0.5 kg frozen unmarinated beef slices in vacuum frying at  $79 \pm 1$  °C, the frying times of 5-10 minutes resulted to higher VFBTPW dried product moisture content (MC). The fat contents, rehydration rate, rehydration ratio and chroma value of the VFBTPW dried products were not significantly different with each other. The frying time of 5 minutes gave the highest product yield due its high MC. The integrated force of the VFBTPW dried products decreased with frying time above 7.5 minutes. The VFBTPW dried product had lower MC, higher fat content and product yield compared with the FD product. The rehydration rate and rehydration ratio of the VFBTPW dried product were lower than the FD product. The beef muscle fibres of the low MC VFBTPW dried product were looser and more porous compared with the high MC product which were more compact as seen in the SEM images. The FD product was more porous than the low MC VFBTPW dried unmarinated beef based on a transversal cut, but the reverse was observed when it is based on a longitudinal cut.

### Speaker D2-2

**Jolin Morel**

Affiliation

Callaghan Innovation

Paper Title

*Gas Expanded Liquids- A tuneable, scaleable green solvent*

### Abstract

Growing concern around climate change and adverse health effects of traditional solvents has led to a growth in the field of "Green Solvents", such as near-critical fluids solvents derived from biomass, and deep eutectic solvents.

Callaghan Innovation is a national and international leader in the use of supercritical CO<sub>2</sub> (scCO<sub>2</sub>) and dimethyl ether (DME) as solvents.

In the last 5-10 years a new class of green solvents has emerged - Gas Expanded Liquids (GXLs), which represent a mid-point between classical solvents such as hexane, ethanol and isopropyl alcohol, and near-critical fluids.

GXLs are liquid solvents in which moderate to high pressure CO<sub>2</sub> is mixed with a medium polarity miscible organic solvent, thereby altering the solvent's viscosity, polarity, density, and solvation properties. By adjusting

temperature, pressure and composition the solvent's properties can be tuned to optimise extraction and separation performance.

GXLs operate at lower temperatures and pressures than scCO<sub>2</sub> extraction, reducing capital and operating costs, and can be easily scaled and recycled, in contrast to some other "green solvent" systems. GXLs can also be applied to biomasses that are partially dry. GXLs can also be used in anti-solvent processes.

This presentation will discuss the principles of GXLs, the use of GXLs to extract high value polar lipids and other compounds from a range of matrices including marine biomasses and plant by-products and compare these solvents to others that can be applied. GXLs allow effective and almost total extraction of high value polar lipids from marine biomasses, and the partial fractionation of these lipids. This work has been partially funded by the MBIE Cyber Physical Seafood Systems project.

**Speaker D2-3**

**Lovedeep Kaur**

Affiliation

Massey University

Paper Title

*Sustainable meat processing technologies for the future*

**Abstract**

Achieving food sustainability has been at the forefront of recent activities in food-related research, the food industry, and policy-making. Changes will need to be made in all parts of the food chain, from production, processing, product storage, to the transportation and distribution of food to the consumers to ensure everyone has access to safe, and nutritious food while catering to the changing demographics and lifestyles. This presentation focusses on role of innovative technologies in future food processing, with a focus on meat and meat-like foods from alternative proteins. The traditional and emerging ways of food processing, including the use of novel ingredients and the use of innovative technologies such as high pressure, shockwave, pulsed electric field, 3D food printing, and microwave-assisted thermal sterilisation will be compared for their effects on food quality, changes in food matrices and nutritional attributes alongside economic and environmental sustainability indicators.

The author acknowledges the vision of the consortium members of the DURATRANSFO project (INRAE, France and other international organisations, including Massey University).

**Speaker D2-4**

**Shakeel Ahmed**

Affiliation

iMonitor

Paper Title

*Integrating AI and Advanced Technologies into MES/QMS for enhanced food manufacturing efficiency*

**Abstract**

In the increasingly complex manufacturing landscape, Manufacturing Execution Systems (MES) and Quality Management Systems (QMS) serve as pivotal tools for optimizing production processes, improving operational

efficiency, and ensuring product quality. The integration of advanced technologies, such as Enterprise Resource Planning (ERP), Supervisory Control and Data Acquisition (SCADA), Object Character Recognition (OCR), Machine Vision, and Digital Twin, into MES/QMS hybrids can significantly enhance their capabilities, resulting in more efficient process design, better guidance for operators based on Standard Operating Procedures (SOPs), real-time traceability, and immediate action on quality defects. This paper investigates the benefits of these integrations within the context of the food manufacturing industry, discussing the specific functions they add to the MES/QMS system and their potential impact on manufacturing efficiency, product quality, and traceability. A case study is currently in progress with a large cookie manufacturer to provide a practical example of the successful implementation of these technologies. Emphasizing the benefits of enhanced traceability, immediate action on quality defects, and real-time breakdown of defects, the paper explores tangible benefits, such as reduced downtime, lower defect rates, and higher overall product quality. In addition, the paper shares insights and provides recommendations for food manufacturers considering similar digital manufacturing strategies. By leveraging these integrated technologies, food manufacturers can not only improve manufacturing efficiency and product quality but also demonstrate the potential of systems as a driving force for innovation and competitiveness in the manufacturing industry to unlock new possibilities for the future of manufacturing.

## Session D3 Traceability and authenticity of high value foods

### Speaker D3-1

**Russell Frew**

Affiliation

Oritain

Paper Title

*From Pilot to Profit: Commercialising Verification of Origin Services*

### Abstract

Food origin verification systems are increasing in importance as global food supply chains become more complex. There are many benefits of implementing a food origin verification system. These include marketing, detection of fraud, protection of the brand and increasing consumer confidence. Regulatory environments are also requiring more companies to provide greater traceability. Geochemical analysis has been extensively used to verify a food product's origin by measuring the food's composition and comparing it to known sources. This is an effective way to verify the origin of food products, but it is more expensive than other methods.

Implementing a food origin verification system can be complex and time-consuming. There are numerous steps from the concept to implementation. This talk will cover the steps from the scientific concept to the implementation of a working audit system for verification of the origin of natural products such as food and fibre.

### Speaker D3-2

**Joy Sim**

Affiliation

University of Otago

Paper Title

*Rapid origin traceability of coffee*

### Abstract

The growing demand for coffee has increased issues of fraud, mislabeling, and adulteration of coffee sold as single-origin coffee. These issues have been exacerbated by the covid-19 pandemic, leading to health and economic consequences. Geochemical tools, i.e., stable isotope ratios and trace elements, and metabolomic tools, i.e., GCMS and NMR are well established and have been used for origin verification. However, they involve time, money, and environmentally destructive chemicals. More efficient and rapid origin verification tools are needed. This project aims to test the potential of near-infrared reflectance spectroscopy (NIR) for rapid origin verification and for predicting origin discriminators from geochemistry and metabolomics. Twenty-four green coffee samples from three continents were successfully classified across various origin scales with the help of advanced machine learning methods. The potential of NIR to predict origin discriminators was also shown, related to altitude, temperature and rainfall differences across countries and regions.

**Speaker D3-3****Phil Marriot**

Affiliation

Monash, Australia

Paper Title

*Enantioselective analysis using GC, MDGC and GC×GC for authenticity of tea tree oil***Abstract**

Multidimensional GC separations (MDGC) achieve much greater separation than a simpler single column analysis. For enantioseparation in classical MDGC a non-chiral first column precedes a chiral 2nd column; we call this GC-eGC. However for comprehensive 2DGC (GC×GC) the column order is chiral then non-chiral, i.e. eGC×GC. The short length 2D column in GC×GC does not allow effective enantioseparation, and we must use fast MS (e.g. 50 Hz) so TOFMS is usual. We have studied tea tree oil for a small number of target chiral compounds, for authenticity, to check possible substitution of non-authentic oils for genuine Australian tea-tree oil. The enantiomeric ratio of each of these was determined for authentic tea-tree oils from producers in Australia and other locations. eGC, GC-eGC and eGC×GC data were obtained. A range of products were obtained from various retailers, all of which claimed to be authentic. Our data did not confirm these claims.

**Speaker D3-4****Kirill Lagutin**

Affiliation

Callaghan Innovation

Paper Title

*Is New Zealand vulnerable to food fraud?***Abstract**

While New Zealand's food industry is renowned for its safety and quality, it is not immune to the global challenge of food fraud. NZ domestic market is notably exposed to intentional fraudulent practices. Counterintuitively, strong food safety culture and compliance exacerbate the exposure. Potential damages caused by food fraud are not limited to the health and safety of consumers, and carry significant reputational, financial, and other risks, including some NZ specific, such as biosecurity. Fraud is notoriously hard to prevent and control due to its intentional and clandestine nature, and the wide spectrum of fraudulent practices. It requires a strategic and multi-faceted approach focusing on understanding of vulnerabilities of existing food safety management system in New Zealand. In this presentation, we will discuss the risks of food fraud to consumers, businesses, and government in New Zealand context, and focus on possible solutions to address the vulnerabilities.

## Session D4 Consumer Insights

### Speaker D4-1

**John Taylor**

Affiliation

University of Pretoria

Paper Title

*Wholegrain Foods - challenges and opportunities*

### Abstract

Whole-grain (WG) foods are relatively more nutritious. However, their consumption in most countries remains well below recommendations. Our survey of 1000 essentially middle-class South Africans revealed that 64% of respondents were confident that they were knowledgeable about WGs. However, 60% selected incorrect WG descriptions. Whilst the majority thought they were consuming almost enough or at least enough WGs, they mostly underestimated the recommended daily amount. Moreover, respondents' knowledge about the actual health benefits of WGs was generally poor. Fat rancidity of milled WG is the major technological challenge. The most effective solution is thermal treatment to inactivate the enzymes responsible. We have achieved some success in retarding WG flour rancidity development by drying the grain prior to milling. Other challenges being addressed centre around increasing the bioavailability of the endogenous micronutrients and improving product sensory quality. Most critically, educating consumers has become essential.

### Speaker D4-2

**Lei Cong**

Affiliation

Lincoln University

Paper Title

*Application of biometric approaches in agri-food marketing: a systematic review*

### Abstract

Social marketing studies face the challenge of cognitive biases in consumers' conscious and self-reported responses. To address this concern, biometric techniques have been developed to capture consumers' implicit and non-verbal responses. A systematic review of 55 research articles and four review ones explored the role of biometric applications in agri-food marketing, showing a steady growth in their use. Eye-tracking is the dominant method used to investigate consumer perceptions, while facial expressions, heart rate, body temperature, and skin conductance are other biometric techniques used. The majority of the studies reviewed had been carried out in either Europe or the USA. A wide range of scenarios concerning consumers' purchase and consumption behaviour for numerous agri-food products have been investigated using biometric-based techniques, indicating their broad applicability. Our findings suggest that biometric techniques are fast becoming a valuable tool for researchers in agri-food marketing, benefiting both academia and industry.



**Speaker D4-3****Erin Young**

Affiliation

University of Otago

Paper Title

*Consumer use of food labelling: a case study using biometrics in consumer food science***Abstract**

Food choice is considered a low-involvement decision process, and self-reporting on determinants of choice can be inaccurate. The use of eye-tracking and physiological measurements to augment self-reported results can provide additional clarity in consumer food science research.

Quantitative food choice experiments and qualitative interviews were conducted, where participants were asked to make several packaged food-related purchase decisions. During the task, the participant's eye movements were tracked to establish which food label components attracted the most attention.

In using food labelling, participants were primarily focused on food identification and then reviewed the packaging in the context of food as a form of sustenance. Some identified differences in viewing behaviour between the clusters could be explained through the lens of individuals' differing food choice priorities and their perceived views on food as a source of sustenance relative to food as a pathway to relationships.

**Speaker D4-4****Josafath Espinosa Ramos**

Affiliation

AgResearch

Paper Title

*Sensory and consumer insights from online product reviews: a case study with coffee***Abstract**

Consumer perceptions and preferences regarding food products have become complex, considering convenience, cost-benefit, sensory experience, and social/environmental responsibility. Traditional methods for understanding consumer insights are time-consuming and costly. However, free-comment online reviews offer a new solution by providing consumers' assessments. This study applied Natural Language Processing (NLP) to analyse online reviews, examining the relationship between product attributes (including sensory properties), consumer sentiment, and five-star ratings. The research introduced a sensory lexicon and methods for evaluating ratings and sentiment. By analysing 17,531 coffee products with 578,900 reviews, the study revealed insights into the correlation between ratings, consumer sentiment, and important attributes like sensory perception, satisfaction, packaging, and delivery. The presentation will discuss the challenges and limitations of NLP for analysing online reviews, along with techniques to overcome them. The study demonstrated NLP techniques' ability to extract valuable insights from free-comment online reviews.

## PLENARY E Science insights into food quality and health

### Speaker E1 Phil Marriott

Affiliation **Monash University, Melbourne**

Paper Title *Do I really need to know the volatile compounds in my sample – and what should I do about it?*

#### Abstract

The high resolution afforded by multidimensional GC and comprehensive 2D GC (GC×GC) techniques is a paradigm shift in capabilities for volatile chemical analysis. Although might be comfortable with our use of GC, we must be aware of the advantages that new operating modes offer. With GC×GC we can:

1. Profile the total sample. This hallmark of ‘super-high resolution’ GC×GC means we see everything in a sample.
2. Have a better-informed GC–MS method. Knowing potential interferences improves GC–MS.
3. Reduce reliance on MS, with FID sufficing in many cases. It is all about separation!
4. Remove ‘chemical noise’, and improve sensitivity for a true trace analysis method.
5. Use the GC×GC ‘picture’ to tell a thousand words for facile sample-to-sample comparison and ‘chemical discovery’!
6. Base decisions on the best method to be used for subsequent analyses – the ‘Unilever strategy’.
7. Assess flavour and aroma using GC×GC and MDGC with FID/O/MS.

Best separation is fundamental to chemical measurement of food-related applications. “If you are not using GC×GC, you will not know what you are missing”.

### Speaker E2 Kathy Glass

Affiliation University of Wisconsin

Paper Title *Formulating foods for microbial safety in the clean label era*

#### Abstract

There continues to be strong consumer demand for prepared foods free of synthetic preservatives. Foremost in delivering this aim is refining processing technologies to eliminate spoilage and pathogenic microbes and environmental control programs to prevent contamination. However, formulating foods to control microbial growth provides additional insurance against improper holding temperature and protecting susceptible consumers. While modest reductions in pH and water activity can slow microbial growth, additional antimicrobials may still be needed. Clean label substitutes exist for some synthetic preservatives, including cultured sugar/milk/wheat, vinegar, cultured celery or beet, and other berry or fruit-

spice extracts. While many commercial clean label antimicrobials are effective, they are not standardised to the same degree as synthetic versions, and can exhibit variability between suppliers and even between lots as well as against various microbes of concern. This presentation will give examples from validation studies of applications and limitations for clean label formulated foods.

**Speaker E3 Warren McNabb**

Affiliation Riddet Institute

Paper Title *New Zealand Milks mean more (NZ3M)*

**Abstract**

NZ3M's hypothesis is that we can harness the variation in composition and structural assemblies in New Zealand ruminant milks, the distinctive processing-induced changes in those assemblies and their consequences for their digestive and absorptive dynamics to produce milk-based foods with consumer-valued and scientifically-validated nutritional outcomes. The different natural and process-induced changes in ruminant milk's structural assemblies affect digestive and nutritional outcomes when consumed as part of our diet. Consequences of interactions between milk structural assemblies and digestive and metabolic processes for nutritional outcomes are ill-defined. To test this, differences in natural and processing-induced ruminant milk structural assemblies, and consequent differences in dynamics of nutrient availability following digestion have been determined. Animal models have been used to understand digestion/metabolism of nutrients from ruminant milks. Human clinical nutrition studies have determined nutritional outcomes for milk-based foods. This knowledge has been used to ensure milk-based foods are a source of valuable nutrition and enable the NZ3M industry partners to build credibility and gain endorsement for New Zealand milks as part of healthy diets that consumers value.

## Session F1 Purpose-led sustainability

**Speaker F1-1**      **Sam King**  
Affiliation          Climate Change Commission  
Paper Title        *An overview of draft advice on the second emissions reduction plan (2026-30)*

### Abstract

Emissions budgets are the Government's stepping stones for reaching Aotearoa New Zealand's 2050 emissions targets. Each emissions budget sets out the net amount of emissions for a five-year period. For each emissions budget, the Government also needs an emissions reduction plan setting out policies and strategies for meeting the budget.

The second emissions budget (for 2026-2030) has been set, but the Government needs a plan to deliver on it. The Climate Change Commission's role is to provide independent, evidence-based advice on the direction of policy for this plan, taking a systems-wide view. We are required to provide this type of advice every five years.

**Speaker F1-2**      **Sandy Botterill**  
Affiliation          Foodstuffs  
Paper Title        *Food in a changing world – a retail perspective*

### Abstract

Our food systems are under incredible pressure. Economic and environmental issues are having impacts that we haven't regularly seen in Aotearoa. We all have a part to play in helping create a sustainable outcome for our food systems, from producing ingredients, raw material supply to manufacturing, packaging, supply chain, go to market and retail operations. This session will share Foodstuffs ESG framework, and our key priorities from an ESG perspective.

**Speaker F1-3**      **Chris McBeth**  
Affiliation          Hydrosys  
Paper Title        *Water, water everywhere, but do you want to drink it?*

### Abstract

Earth's water is in danger. A mere fraction of all the water on earth is fresh and accessible. As the human population nears 8 billion demand from urbanisation, industrial use and agriculture is outstripping supply, and resources are unable to replenish fast enough.

Meanwhile we continue to pollute and abuse our water resources. Heard of dirty dairying? It's true, but its not alone. Industry plays an equal if not greater part in the degradation of our water. Lakes, rivers and ground water resources are increasingly unsafe. By 2035, the UN predicts the globe will be

40% short of the fresh water it needs. A new crisis has emerged, and it is the one thing we need to sustain life; WATER.

We can't rely on old methods to address this. We need to think differently and act with urgency. We need new solutions, FAST. Because without water, there is no "us".

**Speaker F1-4**

Affiliation

*Paper Title*

**Matt Harcombe**

Silver Fern Farms

*Creating goodness from the farms the world needs -  
purpose led sustainability*

**Abstract**

Globally, customer and consumers expectations of food are rapidly and in some cases radically changing. Demand for transparency, traceability, safety, proximity, and nature positive food is starting to influence food production systems to transform. Growth in ethical and sustainable product categories is exponential and those that aren't able to prove these attributes in an authentic and transparent way are being left behind. This presentation will focus on Silver Fern Farms approach to sustainability and track the journey of a product that is a small step towards a much larger system shift to nature positive food production.

## Session F2 Nutrition and Health - beyond micronutrients

**Speaker F2-1**      **Linda Nezbedova**  
Affiliation          Massey University  
Paper Title          *Effects of Monty's Surprise apple consumption on acute antioxidant capacity and postprandial glucose*

**Authors:** Linda Nezbedová<sup>1,6\*</sup>, Sunali Mehta<sup>2,3</sup>, Tony McGhie<sup>4</sup>, Mark Christensen<sup>5</sup>, Julian Heyes<sup>1</sup>, Noha Ahmed Nasef<sup>6</sup>,

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### Abstract

Monty's Surprise (MS) is a heritage apple cultivar discovered in New Zealand with high phytochemical concentrations. Several studies have reported that apple phytochemicals can help regulate blood glucose, improve glucose uptake in cells, and reduce oxidative stress, which is implicated in developing chronic diseases. This study investigated the impact of MS apple puree consumption on human plasma antioxidant activity and glucose levels. Twelve healthy male and female participants received either 500 g of apple puree or a macronutrient-matched placebo in a randomized crossover human study. Blood samples were collected at baseline after overnight fasting and at regular intervals up to 8 hours post-meal consumption. Plasma samples were examined for postprandial glucose and total antioxidant activity using Ferric Reducing Antioxidant Power (FRAP).

MS apple puree consumption significantly increased the total antioxidant capacity of plasma compared to the placebo group ( $p < 0.05$ ). The mean FRAP values of the apple puree group increased from baseline to  $170.78 \mu\text{mol/L}$  at 30 minutes, while the placebo group showed no significant change (from the baseline to  $24.26 \mu\text{mol/L}$  at 30 minutes). Moreover, apple puree consumption led to significantly lower ( $p < 0.05$ ) glucose levels in plasma ( $0.55 \text{ mmol/L}$ ) compared to the placebo group ( $1.20 \text{ mmol/L}$ ) 15 minutes after meal consumption.

This study demonstrated that MS apple consumption increased the antioxidant capacity and decreased glucose levels in plasma. These findings suggest that consuming MS apple could be a promising dietary strategy to reduce oxidative stress and prevent chronic disease development.

**Speaker F2-2**

Affiliation

Paper Title

**Simone Beyer**

University of Otago

*Clinical Research Network for Human Nutrition and Digestive Health***Abstract**

In New Zealand's growing food export market, nutrition and digestive health are common concerns for consumers, central to physical health, mental health, and wellbeing.

The High-Value Nutrition (HVN) Science Challenge focused on New Zealand food & beverage products and their role in health improvement. This allowed to create a novel interdisciplinary collaborative network for human nutrition and digestive health to determine the effects of NZ food & beverage products on gastrointestinal function and overall health benefits. One observational trial and three food intervention trials have been designed and successfully completed in Christchurch (Zespri™ SunGold™ kiwifruit, Zespri green kiwifruit, and a novel grain fiber) and two still active food intervention trials have been designed in Dunedin. These studies go beyond subjective gastrointestinal symptoms by combining a systems biology approach (metabolome and microbiome analyses) with 'physiome' investigations. Christchurch is also one of four research centres for He Rourou Whai Painga, an ongoing study aiming to determine the health benefits of consuming a NZ grown and produced diet.

The recent SunGold study results indicate that habitual consumption of two SunGold kiwifruit daily is effective as constipation symptom management. The outcomes support the use of functional bowel disorders as model to evaluate food and beverage products for digestive health and wellbeing benefits.

The HVN network has enabled the NZ food & beverage industry to promote health benefits of their products in export markets by gathering necessary scientific evidence of the links between diet, bowel symptoms, physiological responses, and the gut microbiome.

**Speaker F2-3**

Affiliation

Paper Title

**Michael Billows**

University of Adelaide/CSIRO

*The role of Gold Kiwifruit in supporting psychological wellbeing***Abstract**

Background: Vitamin C and Kiwifruit intake has been associated with improved mood, vitality, and wellbeing; however, few studies have examined these relationships in individuals experiencing mood disturbance. Therefore, this feasibility study evaluated the preliminary efficacy of gold kiwifruit for improving vitamin C levels and mood in adults with sub-optimal vitamin C concentrations and sub-clinical levels of mood disturbance.

Methods: An n-of-1 multiple baseline design (N=4) was used to examine effects of gold kiwifruit consumption twice daily on vitamin C concentrations and psychological wellbeing, and to offer insights into the feasibility of

recruiting and retaining an at-risk sample. Participants were randomised to a two- or four-week baseline period before commencing the four-week intervention. Participants visited fortnightly for phlebotomy and psychological assessments and completed weekly assessments via smartphone. Participants and researchers were unblinded to baseline condition.

Results: Eighty-one % (110/136) of applicants did not satisfy selection criteria for mood or vitamin C. Inspection of the data demonstrated increases in blood plasma vitamin C concentrations for all participants and reductions in mood disturbance from baseline to endpoint (mean % change = 82.3%) for three of the four participants. Results also highlighted the complexities of regular mood assessments in this population, with sporadic responding and missing data evident.

Conclusion: Gold kiwifruit consumption increases blood plasma vitamin C concentrations and is well tolerated in people with mood-disturbance. Results also provided preliminary evidence of mood improvements. Further studies in such populations should consider feasibility challenges regarding recruitment, attrition, and missing data.

**Speaker F2-4**

**Nicole Roy**

Affiliation

University of Otago/Riddet

Paper Title

*Microbiota-gut-brain axis: new opportunities for dietary interventions*

**Abstract**

Diet is a large influencer of the gut microbiota composition and function across the lifespan. However, whether and how diet can affect the brain via bidirectional communication between the gut and the central nervous system (the microbiota-gut-brain axis) is emerging. Animal studies investigating the potential of nutritional interventions on this axis have advanced our understanding of the role of diet in this bidirectional communication, including microbial metabolites and immune, neuronal, and metabolic pathways, which may be amendable to dietary modulation. Randomised clinical trials using dietary interventions in this field are limited but have high potential applications for clinical nutrition. This presentation will discuss the current state of the literature triangulating diet, microbiota, host behaviour/brain processes, and potential underlying mechanisms. Future dietary interventions should consider the optimal intervention length, including behavioural tests to improve diet compliance and measurement of behaviour outcomes alongside nutritional, physiological and microbiome data.



## Session F3 3 Minute Pitch Competition

3 Minute Pitch Competition, Abstracts in the 3MP Abstract Document

## Session F4 Food Safety: Innovations in microbiology

**Speaker F4-1**      **Tanya Soboleva**  
Affiliation            MPI  
Paper title            *Foodborne Listeria and listeriosis in New Zealand. How are we doing?*

### **Abstract:**

*Listeria* is an important among foodborne pathogens because it can persist and survive in the food processing environments for months, to years. In New Zealand, *Listeria* is found in a variety of food handling environments and occasionally in contaminated food products, including processed meats, raw milk, seafood, dairy products, and different types of ready- to-eat (RTE) foods. Preventing contamination of food products, particularly RTE foods, is essential for protecting public health and avoiding costly food recalls. Ensuring food handlers are supported and trained on food safety and hygiene practices is key to protect consumers. New Zealand Food Safety (NZFS) has guidance documents for *Listeria* control for many types of food businesses and processors. These guidance documents are designed to help food businesses develop, implement, and review control measures for *Listeria*. NZFS also work with consumers to raise awareness of and prevent listeriosis, a serious disease that has caused hospitalisation, and in some cases death. Communication activities target vulnerable population groups like pregnant people and older adults, who are at higher risk of severe illness and death from listeriosis.

With the recent increases in reports of detection of *Listeria* in foods and/or the food processing environment, and the increases in the notified human cases, this presentation will discuss current state and next steps considered by NZFS to prevent contamination of foods, and, in turn, human illness.

**Speaker F4-2**      **Lucia Rivas**  
Affiliation            ESR  
Paper title            *Using genomics to help find a food source for yersiniosis in Aotearoa New Zealand*

Authors: L. Rivas, Horn, B., Armstrong, B., L. Baker, Thom. K., Orton, A., Wang. J., Wright., J, Gilpin, B. (Institute of Environmental Science and Research, Christchurch and Kenepuru)

### **Abstract**

The advancement of sequencing technologies has enabled us to obtain whole sequenced genomes of microbial pathogens with unprecedented

resolution. Genomes of pathogens from multiple sources can be analysed together using various genomic tools which can help elucidate key foodborne sources contributing to human illness. This presentation will outline an example of how genomics is advancing our knowledge on yersiniosis, a gastrointestinal disease with a considerable public health burden in Aotearoa New Zealand (NZ) and predominantly caused by the bacterium *Yersinia enterocolitica*. Although international data indicate pork as an important source of *Y. enterocolitica*, it has been unclear whether this is the case in NZ. As part of a recent case-control study undertaken in NZ, food testing was performed to help elucidate possible foodborne sources contributing to yersiniosis in NZ. A range of *Y. enterocolitica* isolated from food (predominately pork, but also found in other meat types) and clinical cases (who were confirmed as having yersiniosis) were analysed via whole genome sequencing. Genomic comparisons found 'clusters' of food and clinical isolates representing close genetic relationships between these isolates. These results alongside case-control study responses from risk-factor questionnaires (epidemiological information) help provide compelling evidence towards food sources, that can be targeted for mitigation strategies in the food chain. It is anticipated that over time with proper mitigation, the number of yersiniosis illness cases and associated health burden on NZ will be reduced. Genomics also help us gain further information about this pathogen, including identifying key genes associated with antimicrobial resistance and pathogenicity.

**Speaker F4-3**

Affiliation

Paper title

**Craig Billington**

ESR

*Organ-on-a-chip technology for Food Safety*

Authors: Craig Billington, Rob Lake & Jan Powell (ESR)

**Abstract**

Whole genome sequencing of pathogenic microorganisms has significantly increased our understanding of how different strains are genetically related, their potential reservoirs and carriage of virulence genes, but has been unable to elucidate a key question as to why some strains are more likely to cause disease and outbreaks than others. Current 2-dimensional human cell-based and animal models of pathogenesis have also been unable to fully answer this question. Organ-on-a-chip and other 3-dimensional (3D) cell systems are providing new and advanced in-vitro human models to support food safety research, development, and regulation. These organ models use primary and/or immortalized human cells grown in 3D to mimic physiological responses and provide the opportunity to reduce the use of animals in research. They are being used to study pathogenesis and host response to foodborne microorganisms, assess the safety of regulated food additives and provide data for risk assessments. Some examples include liver organ-chips being used for predictive toxicology and pathogen-gut interactions being studied in intestinal organ-chips. At ESR we are using a 3D human colon organ-on-a-chip model to study *Campylobacter jejuni* pathogenicity in

a system that simulates the human gastrointestinal environment. Results from these studies will allow an understanding of the genotype-phenotype relationships in *C. jejuni* in a 3D organ-chip model and will begin to uncover additional insights into the differential pathogenicity of this microorganism.

<b>Speaker F4-4</b>	<b>Anne-Marie Perchec Merien</b>
Affiliation	MPI
<i>Paper title</i>	<i>Challenges, response, and recovery following Cyclone Gabrielle</i>

Authors: Dr. Jefferson Fowles, Dr. Anne-Marie Perchec Merien

### **Abstract**

Between 27 January and 16 February 2023, heavy rainfalls and cyclone Gabrielle impacted the upper North Island. A state of national emergency was declared, and a host of questions arose about food safety and food security with no obvious evidence-based answers available. The physical damage to food-producing areas was extensive, with large quantities of flood waters and silt deposits from upstream sediments of uncharacterised geochemistry covering large areas.

Food safety concerns were raised over uncontrolled sewage release, pathogens, redistributed sediments and heavy metals, agrichemical or petroleum-based chemicals contaminating horticultural crops as well as coastal waters used for local shellfish collecting. Initial data from local government confirmed high levels of *E. coli* in the water outfalls, while heavy metals and agrichemical residues from several Hawkes Bay areas were initially within the expected normal range. More data are needed to confirm that contaminants have not been mobilised and made available to the food supply. Without such data, industry and the government aren't able to determine if localised chemical and microbial contaminants pose a food safety or reputational risk.

This weather event has highlighted how exposed and underprepared we are with the changing climate. Alongside research by other groups, NZFS is proposing a sampling programme of ground and root crops, and shellfish to characterise the chemical and microbiological contaminant impact from silt deposits using GIS mapping and analysis tools to help prioritise risk areas for future events.

## PLENARY G Food Waste

**Speaker G1 Dame Juliet Gerrard PMSCA**

Affiliation Prime Minister's Science Adviser

*Paper title Food waste: a global and local problem*

**Abstract**

In this talk I will give an overview of our work at the science-policy interface on food waste, which we are completing as a series of reports covering many aspects of the food waste hierarchy. I will also reflect on how this work supports government workstreams, in particular the recently launched Te rautaki para | Waste strategy (Te rautaki para | Waste strategy | Ministry for the Environment) and the ever-changing global context in which our food system resides.

## Session H2 Role of food processing for optimum nutrition and quality

**Speaker H2-1**      **Indrawati Oey**  
Affiliation          University of Otago  
Paper Title          *Enhancing the nutritional and sensory properties of legumes through innovative food processing technology*

Authors: Oey, S.Y. Leong, M. Alpos, C. Johnston, P. Khrisanapant (University of Otago & Riddet Institute)

### **Abstract**

Legumes are a sustainable plant-based source of protein. However, they require prolonged cooking to soften their texture and eliminate antinutrients before making them palatable for consumption. Pulsed electric field (PEF), an electroporation-based technology, with an emphasis of inducing structural changes in plant tissue was explored for legume and the textural and nutritional properties of the legume-based product were then evaluated. Our study showed that PEF-pretreated (1 kV/cm electric field strength) cooked black beans (boiled 1 h) were perceived to be chewier (n=22 subjects) and easier to break down into smaller particles. Following a 4-h long in vitro small intestinal digestion, oral bolus from PEF-pretreated cooked beans exhibited a two-fold faster ( $p < 0.05$ ) rate of protein hydrolysis than their untreated counterpart. Clearly, the unique feature of PEF in modifying the structural properties of plant material has facilitated efficient particle breakdown of legume during mastication as well as nutrient hydrolysis during digestion. In response to the increase interest of incorporating legume into food product formulation, a gentle PEF treatment ( $< 0.7$  kV/cm) was attempted on fava beans to assist antinutrients removal, then milled into flour and partially substituted into wheat bread. While the resulting bread was browner and harder, PEF-pretreated fava bean flour with reduced antinutrients and elevated protein content showed promising results for improving the protein digestibility of wheat bread. These examples clearly demonstrate the effectiveness of PEF technology in modifying the texture and modulating the protein hydrolysis of legumes, thus offering an opportunity to upgrade their palatability and nutritional value in everyone's diets.

**Speaker H2-2**

Affiliation

Paper Title

**Haroon Qazi**

Massey University

*Impact of differently structured starch gels on gastrointestinal fate of curcumin-containing nanoemulsions***Abstract**

Starch-based foods offer an interesting platform for the fortification of bioactive compounds, as they can be formulated into different matrices and textures. In this study, we report on the microstructure, physicochemical properties and in vitro gastrointestinal digestion of curcumin-nanoemulsion-loaded corn starch gels formed using starches with different amylose contents, i.e. waxy (WCS), normal (NCS) and high amylose (HACS) corn starches. The incorporation of curcumin nanoemulsion (CNE) into the gels had a significant impact on their initial physicochemical properties. In the gastric phase, the disintegration and emptying of the WCS+CNE gel from the stomach was slow because of the high adhesive nature of the gel, which entrapped most of the curcumin-loaded oil droplets within the gel fragments. In contrast, the NCS+CNE and HACS+CNE gels demonstrated significantly faster gastric emptying of the gel fragments and associated CNE. This variation in the compositional and structural profile of the gastric digesta was further linked to the different rates of starch hydrolysis, the release of free fatty acids and the associated bioaccessible fraction of curcumin. This study demonstrated that the oral-gastric digestion of these starch gels was more dependent on the gel structures rather than on the molecular properties of starch. The dynamic gastric environment resulted in the formation of distinct gel structures, which significantly influenced the composition and microstructure of the emptied digesta, further affecting starch hydrolysis and curcumin bioaccessibility in the small intestine.

**Speaker H2-3**

Affiliation

Paper Title

**Nazimah Hamid**

University of Auckland

*Beyond the Heat: how non-thermal processing can change the flavour of meat products*

Authors: Nazimah Hamid<sup>1</sup>, Qian Li Ma<sup>1</sup>, Indrawati Oey<sup>2</sup>, Mustafa Farouk<sup>3</sup> & Kevin Kantono<sup>1,4</sup>

<sup>1</sup>Department of Food Science and Microbiology, Auckland University of Technology

<sup>2</sup> Department of Food Science, University of Otago

<sup>3</sup> AgResearch Ltd. Waikato

<sup>4</sup>International Flavour and Fragrance, Amsterdam

Corresponding author: Email: nazimah.hamid@aut.ac.nz

**Abstract**

The use of different non-thermal processing techniques, such as cold atmospheric plasma (CAP), high pressure processing (HPP), and pulsed electric field (PEF) can have a significant impact on the flavour and sensory characteristics of meat products. For example, CAP-assisted curing has been

shown to improve the flavour of roasted beef, while HPP and PEF treatments were associated with browned, livery, and oxidized flavours in lamb and beef samples. The type of meat cut used is also an important consideration when carrying out non-thermal processing as it can influence the sensory characteristics of meat products. For instance, PEF-treated chilled and frozen lamb cuts varied in temporal flavour attributes with storage, while the pressure levels applied during HPP influenced the physicochemical and sensory properties of different lamb meat cuts. In addition, the presence of specific volatile compounds, fatty acids, and amino acids are associated with certain flavour attributes in non-thermal processed meat. For example, meaty and juicy flavours of PEF-treated frozen lamb cuts correlated well with the presence of some volatile compounds, while livery and browned perception of both PEF processed chilled and frozen lamb cuts were associated with the presence of certain amino acids and volatile compounds.

**Speaker H2-4**

**Anneline Padayachee**

Affiliation

Expert in Food and Sensory Science

Paper Title

*Food System 4.0: Healthy Food Innovation where Nutrition is the underpinning foundation*

**Abstract**

Non-thermal processes stemming back to ancient times like grinding and sun-drying are the origins of the modern processed food industry. Over time the food supply has evolved in stages:

- Food System 1.0: The Agricultural Revolution beginning in Ancient Egypt which transitioned the sporadic hunter-gatherer supply to a more established food supply on the banks of the Nile

- Food System 2.0: The Safe Bulk Processing Era during the Industrial Revolution (1800s) which coincided with microbiological discoveries that were used in preservation processes

- Food System 3.0: The Automisation, Liberalisation and Globalisation Era beginning in the 1950s saw an increase in consistently available, convenient, energy-dense shelf-stable foods.

While there have been amazing advancements in new product development, flavours, and product diversity, a legacy of the Food System 3.0 also impacts health and the rise in chronic health conditions. Consequently the food industry now finds itself entering Food System 4.0: Healthy Food Innovation. Safe food is an expectation by consumers, however they are demanding foods with greater health and sensory qualities. A truly transformative food system requires transdisciplinary thinking which encompasses the product make up, the supply chain, the impact on the environment, the social footprint, and the effect on health both to individuals and populations. There are 3 key points the current food industry need to consider in real-time to transition into Food System 4.0:

1. Nutrition is not confined to health foods or a marketing team. Foods with health trumps healthy foods.
2. Novel technologies are welcome in the creation of healthier products.

3. Knowledge transfer between sectors is key to success and requires a unified effort.

Everyone, across all sectors, have a role to play in this new evolution in our food supply.



## Session H3 Indigenous Foods in the Pacific Region

### Speaker H3-1

**Dominic Agyei**

Affiliation

University of Otago

Paper Title

*Indigenous foods in the Pacific: A Bibliometrics Analysis of research trends, gaps and potential future direction*

Authors: Dominic Agyei<sup>1\*</sup>, Jimaima Lako<sup>2</sup>, Gade Waqa<sup>3</sup>, Miranda Miroso<sup>1</sup>

<sup>1</sup>Department of Food Science, University of Otago, Dunedin 9054, New Zealand

<sup>2</sup>Department of Food Science, Fiji National University, Suva, Fiji

<sup>3</sup>Centre for the Prevention of Obesity and Non-communicable diseases (C-POND), Fiji Institute for Pacific Health Research, Fiji National University, Suva, Fiji

### Abstract

A renaissance of interest in indigenous foods has been touted as an effective strategy to improve food security and meet sustainable development goals in the Pacific region. However, current studies show that most indigenous foods in the Pacific region have been forgotten or underutilised.

This talk aims to provide a big-picture overview of publication patterns, and the evolution of trends & 'hotspot' research area, using a bibliometrics-based knowledge map of research on indigenous foods in the Pacific region. The phrases 'indigenous/ethnic/traditional foods' and 'Pacific Island', Melanesia, Micronesia, Polynesia (and variants thereof) were searched in the abstract, titles, and keywords of publications on the Scopus databases. The results were exported and analysed using MS Excel (publication output and citations) and VOSviewer (active journals and countries, keyword cluster visualisation).

### Speaker H3-2

**Nick Roskrige (Te Atiawa/Ngati Porou/Ngati Tama)**

Affiliation

Massey University

Paper Title

*Tahuaroa, Neglected Traditional Foods of Aotearoa*

### Abstract

A number of horticultural plants featured in traditional Māori society in Aotearoa-New Zealand and most are underutilised today. They provide the basis for a body of knowledge or *mātauranga* aligned with traditional horticulture; however, not all plants used by the Māori were cultivated. There was also the availability of food stores from 'uncultivated' plants such as *aruhe* (fernroot, *Pteridium* spp.) a range of seaweeds including *kārengo* (*pārengo* or sea lettuce, *Porphyra columbina*) and berries or fruit of tree crops such as the *hīnau* (*Elaeocarpus dentatus*) and *miro* (*Prumnopitys ferruginea*), which were often located near settlements and harvested in much the same way as cultivated plants were. While these crops were considered uncultivated, they were no less managed to ensure maximum

production of the harvested plant parts. The primary cultivated crops included *kūmara* (sweet potato, *Ipomoea batatas*), taro (*Colocasia esculenta*), the *uwahi* or yam (*Dioscorea alata*), various species of *pūhā* or *rauriki* (*Sonchus* spp.), varieties of *tī kōuka* (*Cordyline australis*) and *kōkihi* (NZ Spinach, *Tetragonia tetragonioides*). Since colonisation, a number of other crops have been introduced in traditional gardens and are now considered traditional Māori foods. These include *kamokamo*, a local selection of *Cucurbita pepo*, *taewa* or Māori potatoes and *kānga* or Indian corn. The national Māori horticultural collective *Tahuri Whenua* strive to highlight the diversity of the traditional Māori diet and this has contributed to a resurgence in the ‘cultivation’ of some of these foods. Both the Māori community and researchers are now investigating the opportunities which align to many of the neglected traditional foods in Aotearoa.

**Speaker H3-3**      **Rob Tipa (Ngāi Tahu, Ngāti Kahungunu)**  
*Paper Title*      Traditional uses of native plants

#### **Abstract**

Imagine landing on the coast of Te Waipounamu (South Island) 200, 400 or perhaps 600 years ago with nothing but the clothes you are standing in. In front of you is a wall of impenetrable native bush, the likes of which you have never seen before. Your survival depends on how quickly you can adapt to this new environment, resources you can utilise quickly and ultimately what you can safely eat.

That was the challenge for successive waves of Māori iwi (tribes) who drifted south from Te Ika a Maui (North Island) and later for the sealers, whalers, explorers and settlers who followed them.

Rob Tipa is a journalist who started researching the traditional uses of taonga (sacred) plants of the South Island, in association with Te Runanga o Ngāi Tahu and the Department of Conservation, about 20 years ago.

The project led to a series of 55 feature articles that ran continuously for 14 years in the Ngāi Tahu magazine *Te Karaka* and eventually was published under the title *Treasures of Tāne* in 2018.

Today Rob would like to share with conference participants the stories behind processing and preparing a few of Ngāi Tahu’s key survival foods, including some native plants that were regarded as wasteland weeds or poisonous plants by early European settlers.

**Speaker H3-4**      **Simon Semese**  
*Affiliation*      Massey University  
*Paper Title*      *Highlands Pitpit: A knowledge-rich, multifunctional crop in Papua New Guinea*

#### **Abstract**

Highlands pitpit (*Setaria palmifolia*) has been a crop of significant value in terms of food, medicine, bride price ceremonies and other traditional uses

since ancestral days, matched with a diversity of varieties and traditional names found across the Highlands region of Papua New Guinea (PNG). For instance, the Imbonggu people of the Southern Highlands call it *moi* in the local Imbonggu language, while it is known as *wotani* in the Gahuku language of the Eastern Highlands. The different varieties of highlands pitpit are characterised by colour, leaf shape and other morphology. The local people believe that the geographical location of the crop contributes to its attributes. For example, the Imbonggu District of the Southern Highlands Province has four main varieties: *Moi kapatumbe* (sacred colourful variety); *Moi arimoka* (white stem variety); *Moi gene* (green variety) and *Moi leruku* (purple stem variety). There is also considerable nutritional diversity among the many varieties. It appears Highlands pitpit is only eaten within Melanesian society, especially in PNG. The inner thickened soft base of the plant is the main edible portion and is cooked as a green vegetable or in a mixed meal with meat and other vegetables. Cooking recipes differ per region and tribe.

## Session H4 Challenges in Food Safety

### Speaker H4-1

**Leon Gorris**

Affiliation

Food Safety Futures

Paper Title

*Consumer safe water use and reuse for food production and processing in the face of global challenges*

### Abstract

Water is an increasingly precious commodity in many geographies. Codex Alimentarius, the international standard setting body and food safety risk manager, is developing new guidance on the use and reuse of water for food production and processing that does not compromise food safety and consumer health, but that can address issues of water scarcity where relevant. In addition to general guidance, specific guidance has been elaborated for fresh fruits and vegetables, fishery and dairy products. Competent authorities around the world (about 188 are member of Codex) may adopt the new guidance in mandatory standards or governmental guidance. The Codex guidance is based on scientific advice compiled by the Joint FAO/WHO Expert Meetings on Microbiological Risk Assessment (JEMRA) that is operated under the auspices of the Food and Agricultural Organization (FAO) and World Health Organization (WHO). Through JEMRA, a new framework for science- and risk-based decision-making on fit-for-purpose water use and reuse in primary production and food operations has been established. The science/principles foundation of the framework and its application to the fresh produce, fishery and dairy sectors will be presented in brief.

### Speaker H4-2

**Andrew Pearson**

Affiliation

Tonkin and Taylor

Paper Title

*Food Safety challenges with recycled water*

### Abstract

Urinating on your lemon tree for bigger lemons is a common gardener's myth, however as we progress to sustainable farming systems, this supply could become critical to keep our crops watered. Undoubtedly, New Zealand, like many countries, faces challenges managing water as a resource over the next decades. Increasing urban demand, cultural and environmental requirements to maintain natural flows and climate change impacts on rainfall patterns, will all limit the water from natural sources allocated to agriculture. Internationally to fill this gap many countries draw on recycled water, be it treated wastewater, reuse of process water or urban stormwater, to keep the irrigators running, and even the drinking troughs or aquaculture ponds filled. Such a change fits part of a broader move to circularity in the agrifood sector to limit waste. Drawing from unconventional sources though comes with known and unknown hazards for food safety. These include the presence of bacteria, protozoa,

viruses and conventional and emerging chemical contaminants, which can transfer to crops and animal products and cause a risk to consumers. This presentation provides an overview on the state of recycled water in agriculture and food production, the present understanding of hazards in these water source and how the risks are being assessed and managed for food safety in countries adopting recycled water. Through case studies of schemes overseas, we can see what approaches New Zealand might take to moving to reuse of water while keeping our consumers and markets safe.

**Speaker H4-3**

**Sravani Gupta**

Affiliation

Plant & Food Research

Paper Title

*Emerging Vibrio risk in New Zealand Seafood: Incidence, information/education and methods for postharvest control*

**Abstract**

In December 2022, the Ministry for Primary Industries launched a public information campaign to warn New Zealanders about risks of vibriosis from consumption of uncooked shellfish. This was to an increase in illnesses caused by *Vibrio* bacteria over the last few years. Consecutive outbreaks in 2019, 2020 and 2021 reported 24, 16 and 26 cases, respectively. A prolonged outbreak of *Vibrio parahaemolyticus* illness lasting until June 2022 reported 63 cases. In New Zealand, two main *Vibrio* species are of concern: *Vibrio parahaemolyticus*, which causes gastroenteritis, and *Vibrio vulnificus*, which can cause gastroenteritis that can lead to septicemia and death in immunocompromised individuals. Although there have been no reported New Zealand cases of *V. vulnificus* infection from consuming shellfish, wound infections from virulent strains have been reported. The Food Safety and Preservation Team at PFR have researched *Vibrio* since 1981, focusing on:

1. Surveillance: monitoring the prevalence and numbers of *Vibrio* in shellfish.
2. Ecology: understanding influence of environmental conditions (e.g., seawater temperature changes, salinity, rainfall) on *V. parahaemolyticus* prevalence and proliferation.
3. Pathogenicity: understanding virulence factors of *V. parahaemolyticus*, including adhesins, toxins and effectors.
4. Mitigation: post-harvest control methods, including bacterial growth during storage and modelling inactivation of *V. vulnificus* and *V. parahaemolyticus* using blast freezing and frozen storage.

Of these, we will present results related to effects of postharvest storage temperature on bacterial growth and frozen storage for *Vibrio* inactivation. The findings from these studies provide informative tools for the New Zealand seafood industry, researchers and consumers.

**Speaker H4-4**      **Debbie Hawkes**  
Affiliation          Allergen Bureau  
*Paper Title*          *Allergens: the threshold challenge*

**Abstract**

The 4 parts of the Ad hoc Joint FAO/WHO Expert Consultation on Risk Assessment of Food Allergens have now been published and awaiting formal response from CODEX. A key outcome has been the recommendations around threshold levels in foods of the priority allergens.

The Allergen Bureau strategy is to provide best practice allergen management guidance and resources utilising evidence-based science. Therefore, we recognise that we need to plan how to fully adopt and communicate these recommendations.

The Expert consultation have proposed that threshold levels at Eliciting Dose ED05 are effective, which is an increased level compared to the current VITAL ED01 action levels. So, what do increased threshold levels mean for the Food Industry, and how will this improve labelling outcomes for the allergic consumer?

Additionally, the reference amount (i.e. maximum quantity of food eaten in typical eating occasion) is critical to the correct usage of any threshold levels. The Allergen Bureau is working with TNO, Netherlands to add published food intake consumption data (per global region) to the VITAL Online, risk assessment calculator. This will add a new level of functionality which aligns with the Allergen Bureau strategy to provide best practice allergen management guidance and resources utilizing evidence-based science.

## Session I1 Insights from the past to guide the future

**Speaker I1-1**      **Dave Pooch**  
Affiliation          FNZIFST  
Paper Title        *A history of NZIFST*

### **Abstract**

This light-hearted and brief history covers the enormous contributions that members have made over the decades since NZIFST was first established. Members have generously volunteered their time to become involved in branches, conferences, publications over the decades. In turn, the Institute has recognised their involvement with numerous awards. All of you here will know some of these people and can acknowledge their efforts too.

**Speaker I1-2**      **Mike Boland**  
Affiliation          Riddett Institute  
Paper Title        *A Brief History of Food Processing*

### **Abstract**

Food processing is almost as old as mankind. This brief history will discuss 5 ages of food processing. It will discuss the drivers for food processing in each of those times and the state of knowledge and technology, and the enablers of food processing at the time. The ages are:

- The stone age – prehistoric hunter gatherers
- The bronze age – early agriculture through to ancient Greek and Roman food processing
- The industrial age – the invention and development of industrial food processing
- The consumer age – where food processing was driven mostly by real (and imagined) consumer wants and needs
- 21st Century enlightenment, when sustainability in all its forms is taken into account, with a sneak peek into the future.

**Speaker I1-3**      **Helen Ashworth**  
Affiliation          Cuddon Freeze Dry  
Paper Title        *WGG Cuddon - A NZ Legend. The Cuddon Freeze Dry Story*

### **Abstract**

WGG Cuddon has a lot to answer for. A legend in his own lifetime, he was an incredible designer, engineer and entrepreneur who took the 'kiwi-can-do attitude' to the next level.

Establishing Cuddon Limited in 1938, he started a legacy that has seen the company support our primary industries for nearly 9 decades. Establishing the Cuddon Freeze Dry business in 1957, the Cuddon brand is now synonymous with excellence in freeze dry equipment throughout the world.

John Cuddon grew up within the company, starting with his apprenticeship and taking on the role of Managing Director in 1986. Although now retired, John is still an active member of the Cuddon Board and an owner of this iconic kiwi business.

**Abstract**

**Speaker I1-4**

**Laurence Eyres**

Affiliation

ECCG

*Paper Title*

*Significant historical changes in lipid intakes, science and formulations*

**Abstract**

Since the 1970s, fat, cholesterol, nutrition and health have dominated both the scientific literature and also the public media.

So after more than 50 years research and discourse on this, what is really going on and are we really enjoying a healthier diet?

Saturated fat, trans fat, cholesterol, omega-3 oils, virgin oils etc. have all have featured in some headline -seeking paper and have been then picked up by the media and fuelled public debate.

The author has been in the edible oils and food industry since the start of all these changes and will give his unbiased (?) view of the events, eccentric scientists and the debates that have occurred over the last 50 years.

It will be more fun than Fawlty Towers.



## Session I2 Food structures and effects on digestion and nutrition

**Speaker I2-1**      **Thomas Do**  
Affiliation      Riddet Institute  
Paper Title      *Microstructural organisation of plant-based foods influences starch digestion*

### Abstract

Microstructural organisation of plant-based foods alters the rate and extent at which starch is digested with potential implications for human health. Understanding the relationship between natural plant structure and starch digestion can guide the development of new food products with desirable glycaemic properties. This presentation will describe cotyledon cells and parenchyma cells that naturally occur in legumes and potato tubers, respectively, and show how their structural differences influence the way starch contained within these plants is digested in vitro.

**Speaker I2-2**      **SzeYing Leong**  
Affiliation      Riddet Institute  
Paper Title      *High-protein bread from legumes and protein isolates to improve bread quality and nutrition*

Authors: Sze Ying Leong<sup>1,2</sup>, Courtney Johnston<sup>1,2</sup>, Callum Teape<sup>3</sup>, Veronica Leisaputra<sup>3</sup>, Indrawati Oey<sup>1,2</sup>

<sup>1</sup> Department of Food Science, University of Otago, Dunedin

<sup>2</sup> Riddet Institute, Palmerston North

<sup>3</sup> Department of Computer Science, University of Otago, Dunedin

### Abstract

It's no secret – we know that the slice of white wheat bread we had for breakfast this morning has a high glycaemic index, which causes a rapid rise in blood sugar levels after consumption. This can be problematic for those with conditions such as diabetes or insulin resistance, and can lead to feelings of hunger and cravings for more high-carbohydrate foods. Although we have the option of wholegrain bread, which is high in dietary fibre, vitamins and minerals, the presence of wheat and other gluten-containing grains can be problematic for those with celiac disease or gluten sensitivity. Despite these issues, bread remains a staple food as it is convenient, versatile and affordable food option for individuals and families on a budget. Therefore bread is a perfect food matrix to enrich our daily nutrient intake. To produce a wholesome, balanced and satisfying option for consumers, partially substituting wheat flour with legumes and their protein isolates could be an alternative option, especially to increase daily protein intake. However a well-known quality problem related to the use of legume in breadmaking is the texture. Legumes have a different protein composition

compared to wheat, which affects the structure and texture of the bread. Legume bread may be denser and have a tougher texture than traditional wheat bread. Additionally, legume bread may have a different flavour profile, which may not be everyone's cup of tea.

Our food scientist team at University of Otago has explored different ways of pre-treating the legumes to ensure that when incorporated with wheat flour, the quality and nutritional profile of the bread are not compromised. We have also collaborated with computer scientists to develop an automated image analysis algorithm of bread crumb to assist us in decision-making for the optimal range of legume as a partial substitute of wheat as well as determining appropriate process parameters for legume pre-treatment prior to breadmaking.

**Speaker I2-3**

Affiliation

*Paper Title*

**Faith Descallar**

Riddet Institute

*Gelation and network structure of food gel systems investigated at different length scales*

**Abstract**

The expansion of food texture research has been driven by the need for understanding food physics, particularly food rheology and its molecular phenomenon. Modification of textural properties is a key role in the design and manufacturing of quality food for all consumer groups. This comes into play the utilisation and study of polysaccharides as food additives. In this work, iota carrageenan (IC) was added to agarose gel to study the effect on the changes on the network with aging. Food texture, as well as overall safety and shelf-life expectancy, is highly influenced by storage. Additionally, IC was also introduced to acid milk gel to investigate its gelation enhancement and interaction with milk protein. Different length scales of observations were conducted to elucidate the gelation and network formation of different food system.

Macroscopic properties were explored using bulk rheological and tribological measurements to study the deformation and frictional properties of food gels, respectively. The behavior of solvent in food relates to the texture and flavor release. Solvent mobility in gels were examined using permeability and solvent exudation techniques that revealed the property to hold solvent under external stress which would mimic the chewing of food in the mouth. Mixed agarose/IC gels exhibited slower water exudation and permeation than pure agarose at the same total polysaccharide concentration. These effects were attributed to the water-holding capacity and enhanced friction due to IC chains.

Measurements of mobility of polysaccharide molecules provides insights into the microscopic and molecular properties of solutions during gelation. Nuclear magnetic resonance (NMR) is a powerful tool to characterize the mobility and dynamics of polymer chains. Pulsed field gradient (PFG) <sup>1</sup>H NMR was used to measure the diffusion coefficient of a probe polymer that is embedded into the gels. PFG-NMR provides information on the local interspatial environment of the gel networks. The diffusivity of pullulan as a

probe polymer in agarose/IC gels revealed the hydrodynamic restriction by IC. Furthermore, the diffusivity of poly(ethylene oxide) (PEO) reflected the emerging casein-casein network and its extensive arrangements in acid milk/IC gels.

Passive particle tracking technique was also utilised to investigate the microscopic viscoelastic property. Results revealed that IC altered the length scale of the network arrangements of the acid milk gels which demonstrated a high degree of IC-induced network heterogeneity that continued to develop even at late incubation stage.

**Speaker I2-4**

**Amanda Board**

Affiliation

Riddet Institute

Paper Title

*Interactions and function of Oleosins within oil bodies*

Authors: Amanda J. Board<sup>1,2</sup> Jennifer Crowther<sup>1</sup>, Claudia-Nicole Meisrimler<sup>1</sup>, Geoffrey B. Jameson<sup>2,3</sup>, Renwick C.J. Dobson<sup>1,2</sup>

<sup>1</sup>Biomolecular Interaction Centre, University of Canterbury, Christchurch, New Zealand.

<sup>2</sup>Riddet Institute, Massey University, Palmerston North, New Zealand.

<sup>3</sup>Massey University, Palmerston North, New Zealand.

**Abstract**

Seeds need fuel to germinate. This fuel is provided by triacylglycerides commonly called “fat”. Due to the hydrophobic nature of triacylglycerides they are stored in organelles called oil bodies. Oil bodies are micelles that outer membrane contains phospholipids and proteins which have a hydrophilic side which interacts with the cell and a hydrophobic side which interact with the triacylglycerides. Oleosins are the most prominent protein imbedded in the membrane of the oil body. The terminal ends of oleosins are hydrophilic and sit on the outside of the membrane atop the phospholipid heads. The central section of oleosins is hydrophobic and is called the hydrophobic domain, it anchors the oleosin into the membrane penetrating past the phospholipids into the fatty core of the oil body. The hydrophobic domain contains a highly preserved proline knot motif that creates a hairpin turn and sends the other end of the protein back through the membrane. Despite the understanding of the localisation and primary structure of oleosins the function and secondary structure have been a mystery. Using plant biochemistry I have investigated the function of each of the domains of oleosins, and discovered the interactions oleosin makes with other oleosins and other proteins are essential to carry out its function.

## Session I3 Fermented foods: flavour, nutrition and health

**Speaker I3-1**      **Franco Biasioli (Italy) - supported by Catalyst Funding**  
Affiliation      Supported by Catalyst Funding  
Paper Title      *Use of proton transfer reaction mass spectrometry to understand flavour generation during food fermentations*

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### Abstract

Fermented food encompasses a wide range of food products created through the intentional growth of microorganisms and enzymatic transformations. Fermentation offers numerous benefits that extend to various aspects, including economic value, reduced food waste, efficient energy and resource utilization, environmental considerations, social aspects such as food security, wellness, and preservation of cultural heritage. Traditional fermented products have long existed, and new innovative fermented foods continue to be introduced.

Understanding and controlling fermentation can be challenging due to the involvement of different raw materials, various microbes (both known and unknown), diverse fermentation techniques, and a range of technological parameters and applications. To unravel this complex web, it is crucial to employ analytical methodologies that provide insights into the metabolic processes and allow for rapid and non-invasive measurements.

Proton-transfer-reaction time-of-flight mass spectrometry (PTR-ToF-MS) is a direct injection mass spectrometry (DIMS) technique that enables fast and online measurements of VOCs. With the integration of an autosampler and advanced data processing capabilities, this approach offers enhanced automation, enabling the analysis of wide and complex experimental designs. Furthermore, PTR-ToF-MS analysis aligns with the principles of Green Analytical Chemistry by requiring minimal sample volumes, eliminating the need for toxic reagents, and producing no toxic analytical waste.

**Speaker I3-2**      **Rebecca Roberts**  
Affiliation      University of Otago  
Paper Title      *Monitoring dynamic biotransformation of terpenes during beer fermentation*

### Abstract

To meet consumer demand for hop-flavour driven beers, there is increasing interest to control, optimise and predict hop flavour development in beer. Few aroma compounds present in hops directly contribute to beer flavour

due to changes during fermentation via yeast biotransformation reactions. However, current knowledge of the effect of yeast on hop volatile compounds during fermentation is limited. This makes it impossible to accurately predict how hop additions will impact the aroma of finished beer. The overall aim of the research was to gain a mechanistic understanding of the biotransformation reactions responsible for hop flavour development in beer. To understand hop aroma generation and the role of yeast, pure terpene compounds and model beer systems were investigated using both *Saccharomyces cerevisiae* and *Saccharomyces pastorianus* yeast strains. Individual terpene compounds (10 ppm), yeast (pitching rate:  $1 \times 10^6$  cells/mL) and model wort were added to 20 mL glass head-space vials, sealed and incubated at 20°C for 5 days. Volatile organic compounds were measured throughout fermentation using gas chromatography mass spectrometry (GC/MS) and proton transfer reaction time-of-flight mass spectrometry (PTR-ToF-MS) to further understand the biotransformation of hop terpenes. The results showed that different terpenoids were formed during fermentation, with the depletion of geraniol closely followed by the generation of citronellol, citronellyl acetate, and geranyl acetate as yeast-derived products. The abundance of the products and their formation behaviour was yeast strain dependent. A better understanding of the ability of different yeast strains to biotransform hop terpenes will help brewers predict, control, and optimise the aroma of the finished beer.

**Speaker I3-3**

Affiliation

Paper Title

**Andrea Warburton**

University of Otago

*Understanding the flavour of sourdough bread*

**Abstract**

Sourdough originates from as early as 3000BC and involves the fermentation of cereal flours and water. Although sourdough was traditionally used for leavening of bread, it has experienced a resurgence in popularity, particularly due to its complex flavour generated by the ecosystem of microorganisms, mainly lactic acid bacteria and yeasts, and the long fermentation times used. This flavour is a combination of the volatile organic compounds (VOCs) and organic acids generated during fermentation and baking, but how does the composition of VOCs and organic acids present in the sourdough bread relate to the perceived sensory attributes? This study aimed to evaluate the range of sensory attributes for sourdough bread and investigate the relationships with the chemical composition.

Twelve commercial mixed cultures were used to produce wholemeal sourdough breads using a standardised culture activation and bread making protocol. Rapid sensory profiling was applied using a panel of trained sensory assessors to identify groupings and sensory attributes of the sourdough breads, while the key VOCs and organic acids were measured analytically. The relationships between these datasets were investigated to determine whether specific chemical compounds explained the perceived flavour groupings and attributes of the sourdough breads described by the panel.

Key volatile compounds and organic acids could be related to the sensory attributes of the sourdough breads obtained using rapid sensory profiling.

**Speaker I3-4**

**Jihan Kim**

Affiliation

AgResearch

Paper Title

*Unlocking the potential of indigenous low-value ingredients for kokumi flavour enhancement*

**Abstract**

Kokumi is a unique taste sensation that enhances the richness, mouthfulness, and flavour complexity of food. Kokumi tastants naturally occurs in nature (Alliaceae, beans etc.) and can be produced through microbial fermentation. Many fermented foods such as aged cheese, salami, soy sauce and fish sauce are known to contain kokumi compounds. Kokumi is emerging as new taste/flavour sensation because of its complexity and synergy with other taste qualities for flavor interactions. Developing kokumi flavour enhancers has been challenging, because the flavour interactions that contribute to the kokumi sensation are not fully understood. We have explored a novel approach for kokumi enhancement by screening low-value animal and plant-based ingredients for their kokumi potential. We have identified a range of ingredients that can enhance the kokumi sensation when enzymatically hydrolysed, and we have conducted LC/MS, in-vitro taste-receptor assay and in-house sensory evaluation to assess their effectiveness. Our results show that these low-value ingredients can effectively provide a new avenue for the development of kokumi enhancers. This research has important implications for the food industry as it offers a sustainable and cost-effective solution to improving flavour and consumer acceptance of food products.

## PLENARY J Into the future

### Speaker J1

Affiliation

Paper Title

### Glen Neal

FSANZ

*Reflections on "The New Normal" and what the future may hold for the Food Industry in New Zealand*

### Abstract

Glen finds himself in a role where he gets time to think. He has been thinking a lot about trust & change lately.

He is privileged to lead four teams at FSANZ and whilst the food technologists, labellers and public health nutrition folk are all lovely (and pretty interesting) it's the economists and social scientists and their growing role within FSANZ, and society more generally, that has his attention.

Why? Well economists (Yes it is a science) play a critical role in illuminating the cost/benefit ratio around proposed change. When labelling-changes can collectively cost industry hundreds of millions of dollars there needs to be a significant body of evidence to support such.

Social scientists can filter evidence to help us understand not only what consumers understand, but also how regulated parties might respond to potential new rules. If the evidence doesn't exist, they can gather it – rapidly and relatively cheaply – to help FSANZ make informed decisions about matters that are increasingly polarised. Coming to grips with the 'science of society' looks set to play an important role in an increasingly polarised world.

Glen has been tasked with weaving the conference's keynotes into a presentation that helps attendees synthesise and embed them in future endeavours. Let's see how he goes.

### Speaker J2

Affiliation

Paper Title

### Graham Strong (Ngai tahu)

Innovation Centre, University of Otago

*Preservation and sustainable use of traditional knowledge for future generations*

### Abstract

Biopiracy and misappropriation refer to the unethical and exploitative appropriation of traditional knowledge, practices, folklore, symbols and resources from indigenous communities and local populations by businesses or individuals. Often without proper understanding, respect, or permission all the while denying the historical and cultural significance behind them.

One form of biopiracy is the unauthorised acquisition and patenting of traditional information about medicinal plants, agricultural practices, or cultural rituals. Another is the leveraging of traditional knowledge, without consent, by businesses for marketing purposes to differentiate their products from competitors in the marketplace. By exploiting the knowledge of these communities without their consent or fair compensation, businesses

gain exclusive rights to use and profit from these resources, often without sharing the benefits with the original knowledge holders. This practice undermines indigenous peoples' intellectual property rights and sovereignty, perpetuates cultural theft, and hampers the preservation and sustainable use of traditional knowledge for future generations. Yet it needn't happen; using mānuka as an exemplar, I will attempt to show how businesses might avoid biopiracy and misappropriation of traditional knowledge while leveraging such knowledge to differentiate their business from others.