



# CONFERENCE

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# ABSTRACTS

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**NB, Peer reviewed Abstracts will be marked PEER REVIEWED.**

## Day 1 Speaker Abstracts

### Session A1: Opening Plenary

**Frank Yiannas, Walmart Stores Inc., USA. Sponsored by AGMARDT**

*Global trends in food safety*

Never before in history has the responsibility to provide safe and affordable food to so many rested on the shoulders of so few. And never before in history, have the consequences for not doing so been greater. It is difficult to overstate the difference in our food system today compared to just a century ago, when many of our food safety approaches were first being developed. At the dawn of the 20th century, a majority of consumers worldwide were still living in a pre-industrialized era, living off the land, with most people still involved with food production in some way, shape, or form. Fast forward a mere hundred years and the transformation that has occurred in food production is nothing short of amazing. Today, the way we get our food from farm to fork, the food system, has evolved into an increasingly complex network interdependent on many businesses, stakeholders, and individuals. Although there is no question that the emergence of today's modern food system has provided consumers with a more diverse food supply and convenient source of prepared, economical, and ready-to-eat meals, these trends have resulted in both benefits and additional risks. This session will provide an overview of global food safety trends, emerging food system issues, and the actions needed to ensure consumers worldwide have access to an abundant supply of safe, affordable, and sustainable food.

**Captain David Morgan, Air New Zealand**

*Food Safety culture*

Abstract not available

### **Leaders' Forum – How Food Science and Technology is enabling our business success**

Chair: Katherine Rich, NZFGC

#### **Participants:**

Rebecca Wright, Director, Deloitte Private

John Powell, GM Sales and Marketing, Tatua

Kerry Paul, Director Business Development, Manuka Health

Rob Archibald, CEO Taranaki Bio Extracts

### Session B1: Managing the journey of today's food supply

**Peter Ziegler, Crawford Global Technical Services**

*Title TBC*

**Frank Yiannas, Walmart Stores Inc., USA Sponsored by AGMARDT**

*FOOD SAFETY = BEHAVIOR*

As a food safety professional, getting others to comply with what you're asking them to do is critical, but it's not easy. In fact, it can be very hard. And if you're like

most food safety professionals, you've probably received little to no formal training on how to influence or change people's behaviours.

When it comes to food safety, people's attitudes, choices, and behaviours are some of the most important factors influencing the overall safety of our food supply.

Think about it. If you're trying to improve the food safety performance of an organization, industry, or region of the world, what you're really trying to do is change peoples' behaviours. Simply put, food safety equals behaviour.

How does one effectively influence the behaviours of a worker, a social group, a community, or an organization? While it's not easy, fortunately, there is good news for today's more progressive, behaviour-based food safety professional. Over the past 50 years, there has been an incredible amount of research in the behavioural and social sciences that have provided valuable insights into human thoughts, attitudes, and behaviours. Taking the learning's from these studies and putting them into practice in our field has the potential to dramatically change our preventative food safety approaches, enhance employee compliance, and, more importantly, save lives.

In this innovative session, Food Safety = Behaviour, Frank Yiannas will provide fascinating insights into proven behavioural science principles with suggested applications on how they might be used to advance food safety.

### **Liz Read, Reputation Matters**

*Case Study: How to come through a crisis with your reputation intact*

For ten years Liz Read was External Relations Director for Lion – New Zealand's largest alcoholic beverages manufacturer. Over that decade, Liz was responsible for managing Lion's reputation through a number of corporate crises including a consumer product complaint that attracted national media, fatal workplace accidents, a product recall, the Christchurch Earthquake 'munting' the company's second largest manufacturing facility and a scandal that threatened to destroy its biggest wine brand.

Liz's experience of managing Lion's external response to crises means she has a very clear view of what it takes to come through a crisis with your reputation intact. What's the relationship between processes and people in a crisis? What role does internal culture play? What does it take to be sufficiently prepared for a crisis? And if you're the CEO (with your neck on the line), who's most important to you in a crisis – your lawyers or your communications people?

### **John Barker, Barker Law**

*Legal consequences of product contamination*

A food contamination incident can be an extraordinarily complex and dynamic event. It can resonate throughout the entire network of relationships in which a food business operates, involving employees, suppliers, contract manufacturers, customers, consumers, regulators, insurers and others. Every one of these relationships has a legal dimension that may be affected. Understanding the potential legal consequences is therefore an integral element of managing food contamination incidents.

In this presentation, John Barker will address some of the key legal aspects that should be taken into account when planning around, or reacting to, a food contamination issue. These include:

- Regulatory obligations – what do you need to do and when do you need to tell the regulator?
- Contractual issues – how do you manage your contractual liability?
- Communications – what legal considerations do you need to keep in mind when communicating with customers or consumers?

## Session B2: Itinerary for success

### **Jason Lewthwaite, BNZ**

*Observations and key learnings in China*

Abstract not available

### **Andrew McCallum, MBIE**

*Investor's Guide to the NZ Food and Beverage Industry. How it is changing, diversifying and going up the value chain*

It is no longer true to say that New Zealand is 'just a commodity food exporter'. Significant investment has gone into added value / processed foods in the last few years, and export data shows high growth in a growing range of products. Andrew McCallum will present on the key findings from the 2015 Investor's Guide to the New Zealand Food and Beverage Industry with an emphasis on how the industry is diversifying. This will be supplemented with up-to-date export data and some insights and observations on the New Zealand food and beverage industry and the key role it has in achieving the Government's goal of growing exports to 40% of GDP.

### **Kylie Philips, MBIE**

*Science Funding Landscape*

Have you ever wondered how you as a researcher or you as a company can access Government funding for research, science, technology and related innovation activities?

This overview of the Government's science and innovation funding landscape will cover:

- The Ministry of Business, Innovation & Employment (MBIE) Endeavour Fund, Catalyst Fund, Research Partnerships, Pre-Seed Accelerator Fund, Māori Innovation Fund, and Vision Mātauranga Capability Fund
- Government investment that is channelled through the Food Innovation Network, KiwiNet, and the Royal Society
- Relationships to other Government investment managed by NZTE, Callaghan Innovation and the Ministry of Primary Industries

New Zealand's National Statement of Science Investment, the Business Growth Agenda, Vision Mātauranga policy, and the MBIE Science Investment Plan will be discussed as some of the key documents guiding Government investment in science and innovation.

### **Peter Brown, JAWS**

*IP considerations for F&B exports, added value nutritional products and Standard 1.2.7, and entering into collaborations.*

Session wrap up with an overview of:

- key IP considerations facing F&B exporters (especially into China),
- how to comply with and take advantage of FSANZ's Standard 1.2.7 in relation to health / nutritionally focused added value products in NZ and Australia, and
- IP considerations in your current and future collaborations (the new buzz word!).

## Session B3: Fast tracking NPD

### **Fabian Yukich, Villa Maria Estate**

*How a passion for quality and sustainability drives innovation*

In 1961 Villa Maria was founded by Sir George Fistonich, when he was 21 years old. Over the next 55 years George built Villa Maria into the country's largest family owned winery which today holds a proud record of being New Zealand's most awarded winery for 37 consecutive years.

George has an absolute passion for making quality wine with a commitment to environmental responsibility. These values are deep in the company's culture and have driven the innovation that Villa Maria is renowned for.

Fabian Yukich has been with Villa Maria for 18 years and will discuss how this passion and commitment has impacted on specific areas of product improvement, sustainability and innovation.

This presentation will look at:

- Screwcaps.... How our quality of quality drove this product improvement
- Organics... How our deeply held beliefs around sustainability and quality combined to drive our Organics projects
- Then touch briefly on our developments around Low alcohol wine stressing again how quality is the main driver behind the product development.

### **Kate McKinlay, F&P Appliances**

*LFPD – Thinking inside and outside of the oven*

The adoption of Learning First Product Development at Fisher&Paykel 9 years ago has radically reshaped product development process to enable the delivery of world class technology, quality and design knowledge.

Nearly a decade on LFPD has diffused beyond product development to influence thinking and process in the wider business.

How do we design food and food experiences to tell brand stories, communicate technologies, teach and engage customers, develop internal culture and drive curiosity for customer insights? We design, test and refine content and experiences by following LFPD and LAMDA style thinking.

## Session B4: Meat, Health and the Media

### **Kaylene Larking, MIA**

*Red Meat Sector R&D: building a sustainable future*

The Red Meat Processing Sector contributes approximately \$7.3 billion annually to export earnings for New Zealand. Underpinning the sale of this valuable commodity is a strong culture of Research and Development designed to increase returns from our red meat products both for processors and the farmer.

A key vehicle for supporting collaborative research and development in the Red Meat Sector are Research Partnerships. Jointly funded by industry and Government, Partnerships are companies formed by industry to support the development and commercialisation of R&D of importance to industry. This presentation describes the complimentary work of 3 Partnerships, B+L Genetics, Ovine Automation Limited and MIA Innovation, whose R&D portfolios stretch from the farm to final product packaged by red meat processing companies

### **Emily Parks, Beef and Lamb New Zealand Inc**

*Red meat – A superfood for children?*

Children are a unique population group and vulnerable to nutrient deficiencies. Adequate intakes of protein and essential vitamins and minerals are key to ensure optimal growth and development. A young child is learning to walk, talk, eat and manage difficult textures, and develop social skills. These developmental stages are dependent on brain development which, in turn, is influenced by adequate nutrition. Beef + Lamb New Zealand is responsible for the promotion of beef and lamb on the New Zealand market. With one of its key demand drivers as health, nutrition and wellbeing, much emphasis is given to its activities reflecting evidence based key messages.

The latest Beef + Lamb New Zealand campaign, Way To Grow uses children from within the meat industry in an unscripted setting to help tell the story of the importance of protein for growing bodies.

As with all campaigns, Way To Grow was not without criticism and this reflects the significance of relying on evidence based science when creating nutrition messages for the public.

### **Nicki Bezzant, Healthy Life Media**

*Killer meat? Food and health in the media*

We've never had more information available to us about how to eat healthily. And we've arguably never been more confused about it. The media is a powerful tool and an incredible resource. But it's also a source of much consumer confusion. Between the 24-hour news cycle; the gravitation to social media; the emergence of everyone-as-expert and the drastic changes in the modern media landscape, getting science-based messages about healthy eating out to the world has become increasingly difficult. How can we navigate this, and what does the future hold for nutrition in the media?

### **Gary Acuff, Texas A&M University, Sponsored by IAFP**

*What is really achievable in Pathogen Reduction for Beef?*

It has long been understood that raw foods of animal origin are frequently contaminated with low numbers of bacteria, often including foodborne pathogens. Processing technology continues to improve and evolve as the industry strives to meet lower bacterial contamination expectations. Through time however, sampling

programs have increased in intensity and microbiology testing sensitivity has continued to improve. “Zero tolerance” for pathogens has increasingly become the end goal for regulators. While on the surface this may seem to be a logical evolution in the approach to control pathogens in beef, this presentation will explore the situation a little deeper and discuss possible unintended effects on improving the process and possible ways to move forward.

## **Session C1: The Food Safety Road Code**

### **Ian Ferguson, MPI**

*An update on science at MP*

Ian will provide an update on science at MPI and the importance of science in underpinning all MPI’s activities. His talk will touch on the MPI Science Strategy, the new New Zealand Food Safety Science and Research Centre and the Primary Sector Science Direction, along with other initiatives.

### **Blake Dearsley, MPI**

*How MPI is implementing CIMS: New Zealand’s Coordinated Incident Management System*

The aim of this work is to give Ministry for Primary Industries (MPI) a common approach when responding to threats to Food Safety, Adverse Events, Biosecurity and Trade issues that MPI manages on behalf of New Zealand. This presentation will describe the context behind the recent update of the national standard for emergency response management, the Coordinated Incident Management System, known as CIMS. The business context for responses led by MPI (including Food Safety threats) and the requirements driving MPI’s development of a single and scalable response model will then be outlined. Several Food Safety case studies will be provided to highlight key aspects of this implementation.

### **Glen Neal, FSANZ**

*The evolving offer from Food Standards Australia New Zealand*

Glen (MNZIFST) has recently evolved from MPI to FSANZ. He will share his views on both the strategic context and the five intents of FSANZ.

The ground on which standards are set is hotly contested and not always for the faint of heart. Science is on the side of the good guys though and looks set to remain as talismanic as it has ever been.

Glen will outline FSANZ’s proposed response to the changes in the ecology and speak to the strengths of FSANZ and outline the regulatory challenges that lie ahead.

### **Carol Cullen, QA Carol**

*We have a Food Safety and Quality System that passes audits – what next?*

In the next talk you will hear from a lady who’s had more than 30 year’s involvement in the dairy industry. This included executive positions within NZIFST / DIANZ which enabled her to understand a broader range of food companies. She’ll share her experience of lessons learned in consultancy maintaining Quality Systems

to ISO standards for civil engineering, road construction, bridge building and drainage works; internal auditing and project work for various dairy sites – any quality system can be more than compliance. Since 2008 she has been based in Bundaberg, Queensland taking the same lessons to help her clients over there, writing and maintaining systems for dairy manufacturers, food retailers, growers and processors, builders, aeronautical manufacturers and community groups. One of the things she'll share with you is that different countries and industries may interpret quality standards differently – but there are many benefits that can be applied to any system.

## **Session C2: Longer lasting**

**Dr Alex Schenz, ARCONZ NZ**

*Extend shelf life or 'just' better logistics*

When exporting perishables and food in general, shelf life of cargo can be severely impacted, if logistical processes are beyond real control. In few cases manufacturers may consider to extend product life by investing in technologies and post-production processes; both comes at cost and does not really address the logistical challenges.

Therefore exporters can either resort to selling just from their warehouse, leaving any logistical issues with their customers. Again, this approach does not provide a satisfactory solution in the long-term.

Instead exporters of premium products should enhance their strategy to extend their influence and control further down the logistical supply chain. Despite the costs involved, this gives firstly better understanding and more confidence, but also renders a better level of customer service. Therefore it is about assessing the actual logistic risks and finding a balance between actual and hidden costs on one side and the benefit of an improved product quality ( which is more than maximum shelf life) when exporting perishable products to high-value markets.

**Laurence Eyres, ECG**

*Prevention, analysis of the deterioration of fat in food-extending the shelf life.*

The onset of rancidity or off flavours in food is probably one of the most common causes of consumer complaints and rejection of product.

It can be due to poor quality raw materials, poor hygiene and microbiological contamination, unsuitable packaging, trace metals or excessive heat and light.

The extraction and analysis of oxidation products in food is an area fraught with factors that can produce inaccurate results. There are some basic rules that need to be followed.

Oxidative deterioration is not the only cause of rancidity and other mechanisms will be described.

Examples of case studies will be given in the presentation with suggestions for shelf life extension.

**Gary Broome, FoodTech International Ltd**

*Food Microbiology and new developments in microbial control*

Today's session will serve to provide awareness of new developments in microbial and antimicrobial applications targeted to improve raw food production and

environments, and its handling, processing and packaging to assist a diverse range of food type manufacturers.

Applied technologies presented in power point will include an innovative new fertilizer approach facilitating reduced crop application and run off with significant cost savings. Additionally new developments in food processing such as applied UV treatment, enduring antimicrobials, electrolyzed water, antimicrobial/respiratory packaging, phage and high speed controlled atmosphere processing, all contributory to improving shelf life will be discussed.

### **Anny Dentener-Boswell, ADECRON Food Tech Consulting**

*Will your product stand the test of time? Shelf life testing for local market and export*

Will your product stand the test of time? Shelf life testing for local market and export.

Need to know the shelf life of your product? This session gives you practical tips on how to find out. What times and temperatures and other conditions (humidity, light) to consider. How often to sample. Could ASLT accelerated testing work? Differences between testing for microbiological safety, spoilage and consumer acceptance / quality drop. A micro shelf life protocol example. Differences between closed and opened shelf life. Anticipating temperature cycling and/or transport vibration risk. Difference between Best Before and Use By. Definitions of shelf life. What criteria could be used to define the end of shelf life. Who decides what it is: trained panellists, you, consumers or are there legal limits either here and/or in export countries?

And to finish off some tips on how to use clever design to reduce your workload if you have many different factors at play, as storage trial testing can become very time consuming

## **Session C3: Fast-tracking NPD**

### **Rob Heebink, Gallagher**

*Building a culture of relentless innovation*

Although Gallagher has had innovation and entrepreneurship in its DNA since its inception, creating and sustaining a culture of innovation, creativity and entrepreneurship in a global organisation did not happen by accident. To create an global organisation and brand that consistently delivers innovation that delivers value to its customers, its leadership must have a vision, courage and commitment to , develop the right capabilities, implement appropriate systems and processes, and nurture the right organisational culture. In his presentation Rob will tell the story of how Gallagher achieved this.

### **Dion Cawood, Livestock Improvement Corporation**

*For me, but without me, is against me*

“For me, but without me, is against me” is a Congolese proverb that can provide a different perspective when we ask why traditional innovation efforts are not working.

This proverb also shines light on the mind-set that is at the heart of the LIC NPD story - making it easy to understand why we do what we do - bringing our customers inside our business.

Dion's presentation will feature case studies on the introduction of more customer-centered approaches to product development, including:

- Rapid Prototyping
- Design Thinking
- Lean Start-Up

## Session C4: STECs and measures for control

### **Springer Browne, Massey University**

*Epidemiology of Shiga toxin-producing E. coli (STEC) on New Zealand dairy farms using new molecular and genomic technologies*

New Zealand has a relatively high incidence of human disease caused by Shiga toxin-producing *Escherichia coli* (STECs) compared to other countries, with 4.1 STEC cases per 100,000 population reported in 2014. During the 2014 spring calving season, a cross-sectional study of 102 dairy farms in six regions of New Zealand was performed to assess the prevalence of seven STEC serogroups (O157, O26, O45, O103, O111, O121, and O145) in young calves. These serogroups, the Top 7 STEC, have been globally reported to cause human illness.

Samples were enriched and screened using two molecular methods (RT-PCR and PCR/MALDI-TOF). NeoSEEK™ is molecular confirmation method that has been approved for use by USDA-FSIS and that uses PCR/MALDI-TOF to detect the presence of STEC bacteria without the need for culture (NeoSEEK™ STEC Confirmation, NeoGen Corporation, Lansing, MI, USA). This is the first time, to our knowledge, that this assay has been used for epidemiological studies.

Animal and farm level data, including management and environmental factors, were collected and evaluated. PCR/MALDI-TOF indicated that six of these pathogenic STEC serogroups (O157, O26, O45, O103, O145, and O111) were present on New Zealand dairy farms, with regional distributions varied between serogroups. These risk factors can be used to inform possible on-farm interventions to reduce risk of final meat product contamination and direct human exposure to zoonotic pathogens that commonly present on New Zealand dairy farms.

### **Delphine Rapp and Adrian Cookson, AgResearch**

*Establishing environmental and microbial factors that affect Shiga toxin-producing Escherichia coli (STEC) incidence in dairy herds*

Shiga toxin-producing *Escherichia coli* (STEC) are an important group of foodborne pathogens that can reside asymptomatically in ruminants, including dairy cattle. The development of pre-harvest intervention strategies that reduce the excretion of meat export market-sensitive STEC serogroups (STEC7; O26, O45, O103, O111, O121, O145 and O157) by dairy cattle is envisaged to enhance food safety.

Therefore, further understanding of the factors influencing STEC7 transmission and primary contamination of dairy animals is required.

To examine potential sources of STEC7 contamination, environmental and faecal samples were obtained from adult cattle and calves on a case-study dairy farm over four samplings (May 2014, August 2014, January 2015 and March 2015). STEC O26

was the only STEC7 isolated during the study, isolated mainly in January from 9 of 36 collected samples. STEC O26 were obtained from fresh and stored farm dairy effluents, recently grazed pasture, calf faeces, calf trough water, flies and birds. Genetic subtyping by ERIC-PCR of 312 O26 isolates revealed that STEC O26 isolated from adult cows were genetically similar to those from the farm environment and the calf faeces. Overall, results suggested a limited number of on-farm source for contamination by O26 and the existence of common source(s) between rearing calves and milking herd.

To understand the *E. coli* diversity associated with the bovine gastro-intestinal tract, culture independent methods were used to generate profiles of *E. coli* communities present in calf faeces. These methods have revealed for the first time the *E. coli* diversity associated with the calf gastro-intestinal tract which may influence STEC colonisation and excretion.

### **Gary Acuff, Texas A&M University**

*What is really achievable in pathogen reduction for beef?*

It has long been understood that raw foods of animal origin are frequently contaminated with low numbers of bacteria, often including foodborne pathogens. Processing technology continues to improve and evolve as the industry strives to meet lower bacterial contamination expectations. Through time however, sampling programs have increased in intensity and microbiology testing sensitivity has continued to improve. "Zero tolerance" for pathogens has increasingly become the end goal for regulators. While on the surface this may seem to be a logical evolution in the approach to control pathogens in beef, this presentation will explore the situation a little deeper and discuss possible unintended effects on improving the process and possible ways to move forward.

## Day 2 Speaker Abstracts

### Session D1: Your safety briefing

#### **Brent Gilpin, ESR**

*The role of microbial genotyping in foodborne outbreaks and contamination investigations – Listeria contamination here and overseas*

Subtyping of microorganisms using methods such as serotyping, PFGE and MLST has been invaluable to foodborne outbreak investigations, with subtyping able to link clinical cases together and link cases with sources of contamination. The PulseNet International network ([www.pulsenetinternational.org](http://www.pulsenetinternational.org)) has been a key part of many investigations with subtyping results used to support product recalls, changes to industry practices, and prosecutions both in New Zealand and overseas. A notable feature of prosecutions is the increasing size of fines, as well as prison sentences.

Existing genotyping methods are in the process of being replaced with whole genome sequencing of bacteria. This new methodology offers the possibility of being faster, and more informative. A likely consequence is the identification of outbreaks from smaller numbers of cases, and the ability to link cases with food or other sources on the basis of small number of isolates. For food safety whole genome sequencing and related technologies will have significant impacts.

#### **Mark Bell, Countdown**

*Consumers' perspective*

This presentation discusses the impacts on consumers, and on the supermarket, when things go wrong.

While the cause may be from an operator's manufacturing error, such as foreign body contamination, or incorrect labeling leading to undeclared allergens, or from external crises such as Hepatitis A in imported frozen berries or an outbreak of Yersinia, there is a significant impact on consumer confidence whether the consumer has been directly affected or not.

A product withdrawal, or in the worst case a product recall, may resolve the immediate problem of a potentially defective product however there is a wider consideration, New Zealand consumers need to maintain confidence in the food they buy and consume, and in the retailers they purchase from. So how does this sit when they have been inundated with scares affecting infant formula, vegetables, and even horsemeat masquerading as beef?

#### **Roy Biggs, Tegel**

*30 years of Micro investigations*

Roy will discuss the principles that underpin the approach to investigations:

Identification of the organism causing the problem

Understanding it, own knowledge & research to understand growth requirements and survival characteristics – habitat, food source, temperatures etc.

Using that information to find and control it

Most plants have good heat treatment so the search is usually for post heat treatment contamination

Spoilage organisms can have significant economic impact that can be nearly as devastating for a company as pathogen contamination

Roy will relate some experiences with a range of organisms in different environments

### **Euan Brouwers, Staubli**

*Food Safe Design – Machine design methodology - Integrating Hygiene into the equipment design concept*

This presentation outlines criteria for the hygienic design of machines intended for handling and processing food, using a six axis robot as an example. The fundamental objective of the methodology is to prevent contamination of food by micro-organisms during processing. Machines not designed for purpose may harbour residues on rough surfaces and in confined spaces that are difficult or even impossible to clean. Cables, pneumatic hoses, oil leaks and non-homogeneous materials all present a contamination risk. The materials and coatings used in the construction of machines must be able to withstand frequent and aggressive chemical cleaning designed to expunge residues and kill the microbes that could cross-contaminate subsequent batches of product. Validation of the design efficacy and component traceability are important elements in ensuring the hygienic measures implemented in the design remain effective over the life cycle of the machine.

## **Session D2: Product ideas for the booming baby boomer market**

### **Denise Conroy, University of Auckland**

*Midlife crisis – the neglected consumer group*

The voice of the consumer is all too often absent in the food marketing literature, and this is particularly evident for middle aged consumers. The middle-aged population - usually described as people within a 40-65 year old age bracket (Cavanaugh, 1990) is a large and growing group that may have unique characteristics as consumers of food and health provision, and yet little is known of their needs, attitudes, emotions and desires. More focus has been given to understanding the young and the old, and yet the middle aged are often affluent, well-educated and actively seeking to consume foods that will maintain or enhance their health. Despite this, the criteria that may motivate selecting food products among this age group are not well researched. Understanding why this age group is unique, and why it is crucial for their voice to be heard, will be my focus.

### **Kaye Dennison, Optimize Health Solutions Ltd**

*Memory, Mobility, Muscle and Money – essentials for optimal nutrition and ageing*

Research shows there is a number of dietary interventions the “Baby Boomer” generation can adopt to improve their health in ageing. There are also a number of non-dietary factors that will influence the ability of people to age successfully. Simply increasing the intake of nutrients that support optimal ageing is not sufficient, often the older person’s complex medical conditions, medications and

mental health have more influence over their nutritional intake, than the availability and access of suitable foods.

This paper outlines dietary changes to support ageing and covers barriers to achieving optimal nutrition based on physiological and psychosocial issues, affecting older people. Some of these barriers can be addressed by improving health literacy, access to fortified foods, packaging and overall food security.

Health organisations are adapting their services to meet the future needs of “Baby Boomers” and other service providers to this population group need to do the same.

**Lisa Duizer, University of Guelph**

*Aging and flavour perception. What happens?*

While having a meal, all individuals use each of their 5 senses to evaluate the sensory properties of foods. During aging, there are changes in these senses which may lead to an impairment in an individual’s ability to perceive all the sensory aspects of a food. Perception of tastes and odours which, when combined, provide an indication of the flavor of a food can be significantly altered with aging. While it is well documented that these changes in sensory capabilities exist, there is no clear agreement on the effects of such changes on liking and intake of foods. Some research indicates that intake is affected by age-related changes in perception, whilst others have not found such a relation. One reason for this may be the heterogeneity of population. Two people of the same age may have very different capabilities. This makes the development of foods that appeal to the majority of the older adult population challenging. Research must focus on identifying groups of older adults as they relate to liking and then products must be developed to appeal to these groups. Understanding patterns associated with liking will ensure that product developers will be able to develop food products that will be liked and consumed by the older adult population.

PEER REVIEWED

**Eli Gray-Stuart, Massey University**

*I can’t open my baked beans any more!*

As we age our sight, strength and dexterity all diminish. This can have a significant impact on such fundamental tasks as opening food packaging and can influence the products people choose to buy. This research explored ageing consumers’ attitudes towards currently available food packaging in New Zealand. Ninety-nine individuals (over the age of 60) in New Zealand were surveyed to determine packaging attributes of importance when selecting food products. Common problems encountered with food packaging included tight lids, small printing and spillage during opening. Several package closures were investigated and it was found that opening of packages, rather than resealing of packages proved most problematic. Fifty percent or more of respondents either ‘very often’ or ‘frequently’ had problems with peelable induction seals, lug closures and continuous thread closures. Over sixty percent of participants had asked for assistance to open some types of packages, and this was particularly prevalent among individuals who had weakness in their arms, hands or wrists. Participants suggested changes to package closures including increasing the size of twist off caps, larger ring pulls on aluminium cans and including more sliding resealable closures on foil and plastic packaging. Larger printing on labels was also recommended. With several common difficulties the participants identified in this work, and an ageing population, it will become

increasingly important for manufactures and package designers to be aware of these issues and produce user friendly packaging for the benefit of their consumers.

## **Session D3: Market Driven NPD**

### **John Barker, Barker Law**

*Developing products for export markets: a legal perspective*

When you develop a new product, thinking about legal matters such as product compliance, labelling and marketing claims, intellectual property and contractual relationships is difficult enough. But when products are exported, these considerations are multiplied because almost every market has different rules. Producers can get caught out if products are not developed with export market rules in mind. Planning ahead can also maximise efficiencies, for example by avoid costly re-works or re-formulations each time a product goes to a new market. In this presentation, we will cover some of the key legal pitfalls when developing products for export,

### **Max Kennedy, MBIE**

*Science and Engineering research across the food value chain*

The Government's Budget 2016 announcement for Science and Innovation is one of the most significant and exciting packages to date. 'Innovative New Zealand' is a series of 25 initiatives with a total of \$761 million invested over the next four years in science, skills, tertiary education and regional development initiatives to build a stronger economic future for New Zealand.

Government enables in science and engineering research across the food value chain - important national initiatives include the High Value Nutrition National Science Challenge, the New Zealand Food Safety Science and Research Centre, and Food Industry Enabling Technologies.

New Zealand also participates in a number of international activities that are crucial to building and strengthening our global connectivity, such as the International Knowledge-Based Bio-Economy (KBBE) Forum, the Innovation to Industry expo in Japan, and the Facilitating Research and Innovation co-operation between Europe and New Zealand (FRIENZ) Research and Study Tour on Food.

### **Lou Sherman, Scion**

*The power of packaging*

Packaging has the power to make or break product sales in today's fast changing market. In a literal sense, well designed packaging will prevent the breakage of products, but it also has huge potential to attract customers, provide a memorable experience and reinforce brand values. Today I want to introduce global research that explains the fundamentals of consumer behaviour that can be influenced through packaging design. I will include inspirational examples of innovative packaging demonstrating how international companies have successfully captured this potential. Factors including colour, shape and material selection will be discussed, and, more importantly, how these factors can be used to manage emerging consumer expectations and demands such as sustainability and transparency on where their product has come from. I will also share examples of

Scion's packaging material research, which can be used to address these emerging requirements.

### **Rob Archibald, Taranaki By-products**

*Focusing on the customer's needs*

From time to time manufacturers for the food service and ingredient sectors will be approached by a customer with a real need. This is a need that can't be satisfied elsewhere and which the manufacturer could possibly make but doesn't currently. This poses a dilemma for the manufacturer – to embark on a new product development project or to pass up the opportunity. Having a committed customer will usually ensure market driven new product development, initial orders, and the opportunity for the manufacturer to expand into other areas. However the customer's product needs may be very secondary to the customer's business needs. 3 case histories will be presented illustrating the need to spend time fully understanding the customer's total needs.

## **Session D4: A joint voyage - partnering for innovation**

### **Mustafa Farouk, AgReserach**

*Maximizing value from the whole carcass*

The New Zealand Meat Industry is adept at extracting value from slaughtered animals and in exporting their high quality meat around the globe. However, for the industry to remain competitive and profitable, it must maximise its profit from the whole carcass post farm gate. This can be done not only by further differentiating the existing cuts, creating new ones and finding novel uses for the lower value and down-stream cuts, but by also becoming the supplier of meat solutions and ingredient functionalities to end users including processors, retailers and the ultimate consumer. This presentation focuses on how some of these goals can be achieved.

### **Emma Bermingham, AgResearch**

*Differentiation of New Zealand red meat: using advanced metabolomics*

Emma N Bermingham†, Arvind K Subbaraj and Karl Fraser  
Food Nutrition Health Team, Food & Bio-based Products Group, AgResearch Ltd,  
Palmerston North, NZ.

†Corresponding author

Abstract: NZ's Red Meat Sector aims to sustainably increase profitability of the red meat industry, in part through value-add initiatives. There is an opportunity for the NZ red meat industry to 'rebrand' from a commodity-type product, to a niche category product that is consumer-centric. This study aims to understand 'what' NZ red meat is at the metabolite level. As a pilot investigation, we analysed lamb and beef products purchased from a NZ meat retailer. Meat extracts were analysed for non-polar/lipids (CSH-C18), polar (HILIC) and semi-polar (C18) compounds using ultra-high performance liquid chromatography mass spectrometry (UHPLC-MS). 237, 1837 and 2700 metabolic features were detected, respectively. Metabolite profiles differed between beef and lamb, and between beef cuts. Non-targeted LC-MS metabolomics can therefore be used to understand how we can differentiate NZ red meat. This may provide a tool to generate consumer-centric products and thereby add value to NZ's red meat products.

**Santanu Deb-Choudhury, AgResearch**

*Proteomic and peptidomic differences and similarities between four muscle types from New Zealand raised Angus steers*

Four muscles from New Zealand-raised Angus steers were evaluated (ST, LTL, PM and IS) to test their differences and common features in protein and peptide abundances. Protein profiling based on two-dimensional electrophoresis showed that the overall profiles were similar, but, between muscle types, significant ( $p < 0.05$ ) intensity differences were observed in 24 protein spots.

Profiling of endogenous peptides allowed characterisation of 346 peptides.

Quantitative analysis showed a clear distinction between the muscle types. 44 peptides were identified that showed a statistically significant ( $p < 0.05$ ) and substantial ( $>2$ -fold change) difference between at least two muscle types.

These analyses demonstrate substantial similarities between these four muscle types, but also clear distinctions in their profiles; specifically a 25% difference between at least two muscles at the peptidomic level, and a 14% difference at the proteomic level. The ultimate goal of such a comparison is to match muscle types to products with targeted properties.

**Marlon Martins dos Reis, AgResearch**

*Non-invasive assessment of food provenance*

Name(s) of author(s): M.M. Reis<sup>1</sup>, A. Stuart<sup>1</sup>, C. Craigie<sup>1</sup>, K. Taukiri<sup>1</sup>, A. Karrer<sup>4</sup>, E. Martínez<sup>2</sup>, E. Saitua<sup>2</sup>, R. Rodríguez<sup>2</sup>, I. Pérez<sup>2</sup>, I. Olabarrieta<sup>2</sup>, K. McComb<sup>3</sup>, G. Brightwell<sup>2</sup>.

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The global economic impact of food fraud is estimated in US\$50 billion, annually. New Zealand's food industry is able to claim significant premiums for their products due their prized reputation for quality and safety. Recent food crises have shown that the complexity of supply chains increases the vulnerability to food fraud and that premium products are the preferred target for economic gains. Thus the New Zealand food industry is at high risk of economic and reputational loss due to food fraud. This vulnerability was clearly seen during the 2013 lamb roll scandal in China where tainted lamb products were marketed as New Zealand products. Thus there is increasing demand for a non-invasive, cost effective and easy way to assess authenticity of food products. In this study, we investigated Near Infrared Spectroscopy (NIRS) as a tool for authentication of muscle foods in regards to differentiation of species, origin and freshness. Hyperspectral imaging in the NIR region was able to differentiate lamb meat from beef and pork. NIRS detected correctly (with 90% probability) whether meat samples are from New Zealand compared with Spanish samples; and predicted correctly (with 92% probability) fresh tuna as fresh tuna and (with 82% probability) that frozen/thawed is really frozen/thawed. Overall, our results indicate that information captured with NIRS and Hyperspectral imaging allow detection of multiple attributes of interest for

authentication of muscle food allowing development of a non-invasive tool to be used in the field for authentication of claims associated to food specie, origin and freshness.

PEER REVIEWED

## Session E1: Plenary

**Hayden Green, PWC**

*Megatrends and their impact on Food Fraud*

Global megatrends such as technological breakthroughs, resource scarcity and rapid demographic shifts are colliding together and transforming the way we produce, sell and eat food.

It's a world without borders, where disruption anywhere can rapidly have significant consequences for everyone. Customer concerns and expectations about what's important are growing, with food fraud just one of these growing concerns.

Globalisation and increasingly complex supply chains are creating huge opportunities and rewards for fraudsters. The collision of megatrends – particularly climate change and resource scarcity, urbanisation and demographic change – are increasing vulnerabilities and making it easier to profit from fraud. Today, even the most basic foods can involve huge numbers of suppliers around the world.

Companies are losing money and customers are losing faith. Food fraud is estimated to cost the global food industry US\$30 to \$40 billion every year. But beyond the economic cost, food fraud can harm public health and damage brands.

**Gary Acuff, Texas A & M University**

*Addressing Risk using process validation and performance objectives*

It is increasingly important to assure that process interventions implemented to control pathogenic bacteria are functioning correctly and achieving desired goals.

This is necessary not only to assure that the interventions are having both the desired positive effect on food safety, but also to provide assurance to the processor that their investment in food safety is in fact providing the appropriate benefit for the investment. Validation is a fundamental part of HACCP, and processors who currently have HACCP plans in place should validate the plans and process control as part of proper implementation. This presentation will discuss a practical approach to developing validation protocols, specifically addressing the utilization of indicators or surrogate bacteria to estimate pathogen response to process controls, and utilization of data to address performance objectives.

## Session F1: Tracking the journey

**Peter Stevens, GS1**

*Traceability – lessons from WPC-80 and “skating to where the puck is GOING TO BE (not where it has been!)”*

Canadian ice hockey star Wayne Gretzky famously explained his unrivalled reading of the game by stating that he skated to where the puck was going, rather than where it has been. And so it is with traceability and the consumer's insatiable desire for information about food. Peter will share some of the lessons from spending a

year of his life on the Dairy Traceability Working Group and tackle some of the tricky issues that need to be thought through for all those in the food supply chain.

**Melissa Welsh, GSI**

*Research results: Traceability costs*

Traceability is the capability to trace goods throughout the distribution chain. Traceability has become an increasingly important research area in recent years. It has always been an important aspect of production, but recent contamination events have highlighted its significance. The Fonterra botulism scare of 2013 in particular exposed a need for fast accurate product tracing in the New Zealand Dairy industry.

We develop a model for the flow of milk from the farm, through to the first stages of processing at the factory. At each stage we incorporate testing and tracing parameters for the detection of contaminants and the rejection of affected product. As we vary these parameter values we alter the precision of the traceability system. The difference in output with various levels of traceability allow us to estimate how much traceability is worth and where it is worth the most.

**Todd Gordon, Oritain**

*Traceability beyond the label*

"Fruit is being dipped in dye to make it more appealing. Totally synthetic honey is being sold that contains aluminium. Or how about minced beef being replaced by horsemeat? If this was one of your brands what would you do?

Fraud in the food supply chain is pervasive and traditional traceability methods are easily exposed.

Our participation at NZIFST will serve to show you how scientific traceability can protect brands and help businesses build deeper trust with consumers.

We will also discuss how New Zealand must protect our 'clean and green' image and focus on protecting integrity in order to compete in overseas markets, and build customer loyalty"

**Pam Whitfield, AsureQuality**

*Evolving expectations around traceability in export markets*

The continued globalisation of trade complicates transparency and accountability within food supply chains. As our major export markets increasingly demand that manufacturers' and brand owners' mitigate these realities through revised regulation, studies have shown that consumers are willing to pay a premium for food with transparent and credible provenance assurances. In this presentation we take a look at these regulatory changes, and how AsureQuality is helping industry to prepare and embrace these shifts as opportunity to develop competitive export advantage.

**Session F2: Product ideas for the booming baby boomers market**

**Denise Hamblin, Colmar Brunton**

*Growing opportunity with "Grownups"*

Authors: Dr Denise Hamblin & Peter Kenny, Colmar Brunton

The proportion of “Grownups” represent an ever increasing potential share in the consumables market. However, up until now, they have had negligible consideration as a target cohort for new product development. The focus instead, has largely been on pre-family individuals and young families who represent the largest spend and are ideally positioned for a future of brand loyalty. But the tide may be turning, as life expectancy increases and evidence of a future era of customisation nears. This presentation will review target age groups for innovation within the FMCG industry over the past two decades, from an ANZ-perspective as well as a broader Asia Pacific-perspective. It will pose the question as to “why?” Grownups have not been a focus of innovators and what changes may lead to this group being prioritised in the future.

**Lisa Duizer, University of Guelph**

*Enhancing nutrition in selected foods for older adults.*

The risk of malnutrition in long-term care homes is high. Protein deficiency as well as deficiencies in Vitamins B6, B12, C, D and E, calcium and magnesium have been documented. While some individuals take vitamin supplements, for others this is not possible due to swallowing difficulties and/or an inability to consume pills. Therefore, a food first strategy must be adopted which can accommodate the nutrient needs of older adults without adding extra food to the plate. We have been investigating two such strategies. The first is the addition of a micronutrient powder which can be incorporated into the foods commonly consumed by individuals in long-term care. While addition of this powder changes the sensory properties of foods, the overall liking of the foods is not affected. Interviews with the people who prepared and served these foods, however, revealed concerns about the amount of the powder added to foods in terms of safety for consumers. Cost is another major concern. Because of these issues, a second strategy is currently being examined. The micronutrient content of selected menus prepared for long-term care homes is being determined and alterations to foods included in these menus are being undertaken to improve nutrient content. Such alterations include the substitution nutrient-rich ingredients for those with less nutrients as well as the addition of herbs and spices to foods. It is anticipated that findings from this research can be used to develop foods with better nutrition for older adults living in long-term care homes.

PEER REVIEWED

**Pam von Hurst, Massey University**

*Is there a case for Vitamin D fortification in New Zealand foods?*

This paper will define Vitamin D: what it is and how we measure it and cover skin synthesis and the effect of aging, time outdoors etc. The current situation regarding Vitamin D in the food supply and population status in New Zealand compared with overseas. Closing discussion will look at latest research into Vitamin D and health/disease status.

### **Session F3: Novel technological toolbox for food innovaton**

**Ralf Greiner, Max Rubner Institut**

*Improvement of Food Quality using phytases*

Ralf Greiner<sup>1</sup>, Indrawati Oey<sup>2</sup>

<sup>1</sup>Max Rubner-Institut, Department of Food Technology and Bioprocess Engineering, , Germany, <sup>2</sup>University of Otago, PO Box 56, Dunedin 9054, New Zealand,

Phytases [myo-inositol(1,2,3,4,5,6)hexakisphosphate phosphohydrolases] initiate the stepwise dephosphorylation of phytate. In recent years, the use of phytases for food processing has attracted a lot of interest because the decline in food phytate results in an enhancement of mineral bioavailability. Different strategies could be applied to optimize phytate degradation during food processing and digestion in the human alimentary tract such as adjustment of more favourable conditions during food processing for the phytases naturally occurring in the raw material, addition of isolated phytases to the production process, and the use of raw material with a high endogenous phytase activity. Furthermore, phytases may find application in the production of functional food, because individual phytate dephosphorylation products have been shown to have important physiological functions in man. Besides improvements of food quality, phytases can be added during food processing to solve technological issues. However, so far none of the phytases commercialized are specifically used for food applications.

PEER REVIEWED

**Jim Jones, Massey University**

*Adding value by culinary smoking*

Jim Jones<sup>1\*</sup>, Georg Ripberger<sup>1</sup>, Graham Eyres<sup>2</sup>, Richard Archer<sup>3</sup>

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Smoking adds value to products like fish, wild foods, processed meats, cheeses, nuts and some vegetables. Salmon is the major smoked export from New Zealand which, when smoked, retails at double the price in the USA market. The purpose of this paper is to highlight the technology of smoking and the gaps where opportunity exists to add further value. Culinary smoking involves two unit operations, the smoke generator and the smoke house or kiln. After food items are loaded into the smoke house, they are ramped through a profile of temperature, humidity, air rate, recycle and smoke addition. This continues until the desired product characteristics of dryness, flavour, colour and visual appeal are obtained. Smoke house control, while complex, is based on the well-known principles of heat and mass transfer which means variability is able to be minimised. In contrast, the smoke generator is less easily controlled, not so much in terms of the rate of smoke generation which is an averaged quantity, but in terms of its chemical profile. Some 400 compounds are produced. These contain desirable and undesirable flavour notes, and polycyclic aromatic hydrocarbons for which the European Union has recently imposed maximum limits. Thus, the smoke generator presents an opportunity to tailor aroma profiles to provide more precision to smoke house operators and flavour distinction to producers. This paper is focussed on the technology. In a separate paper, we focus on the science of culinary smoking.

PEER REVIEWED

**Sally Hsieh, The University of Auckland**

*Nanotech Optical Sensors for the detection of adulterants and heavy metals in beverages*

Name(s) of author(s): Pei-Huan Hsieh (presenter), Joseph Vella, David E. Williams, Dongxiao Sun-Waterhouse and Geoffrey I.N. Waterhouse\*  
Affiliation: School of Chemical Sciences, The University of Auckland.

Concern about adulterants and metals in beverages motivates the development of new technologies that can selectively detect and quantify these contaminants at low concentrations. Here we describe the successful development of two nanotech-based optical sensing systems with potential for food industry uptake. The first is a photonic-crystal based surface enhanced Raman (SERS) substrate, comprising gold (Au) nanoparticles on a porous TiO<sub>2</sub> support which can detect aqueous melamine at concentrations as low as 100 ppb. The second system is nitrogen-doped carbon nanoparticles (NDCNs), obtained by hydrothermal treatment of various natural products (chitosan, wool or human hair) at 200 °C for 6 h. When dispersed in water, the NDCNs exhibit intense blue photoluminescence at 410 nm under UV (365 nm) excitation. The photoluminescence is strongly quenched by aqueous metal ions (Hg<sup>2+</sup>, Cu<sup>2+</sup> and Fe<sup>3+</sup>). These examples highlight the enormous potential of nanotech-based optical systems in both food safety and the beverage sector.

PEER REVIEWED

### **Mike Boland, Riddet Institute**

*Innovative processing technologies for meat tenderisation*

Name(s) of author(s): Mike Boland<sup>a\*</sup>, Clara Baha,<sup>c</sup> Lovedeep Kaura,<sup>b</sup> Abby Thompson<sup>a, b</sup>, John Bronlunda,<sup>b</sup> Michael Parker<sup>b</sup>, Cameron Craigie<sup>c</sup>, Mustafa Farouk<sup>c</sup>, Maryann Pirie<sup>c</sup>, Indrawati Oey<sup>a, d</sup>, Phil Bremer<sup>d</sup>, Pat Silcock<sup>d</sup>, Amali Alahakoon<sup>d</sup>  
Affiliation(s): <sup>a</sup>Riddet Institute, <sup>b</sup>Massey University, <sup>c</sup>AgResearch Limited, <sup>d</sup>The University of Otago

The New Zealand meat industry represents more than NZD 6.5 billion of annual export revenue. A large volume of low-value meat associated with current processing operations presents a substantial opportunity cost to the industry. These low value, underutilized meat cuts often have a good flavour but a tough texture. Our project aims to develop a combination of processing technologies that will enable the New Zealand meat industry to transform low-value meat cuts into premium export products. The new technologies focus on pulsed electric field processing and sous vide tenderisation and combinations of these. Our research focuses on relating the physicochemical changes induced by processing to the degree of tenderization and other desired textural and flavour changes. The project is a collaborative effort between research partners - 3 Universities (Massey, Auckland, Otago) and 2 CRIs (AgResearch and Plant & Food Research) and the Riddet Institute - under the MBIE-funded Food Industry Enabling Technologies (FIET) Platform. Industry involvement is an important aspect of this project. We currently have three industry partners (ANZCO Foods, Alliance Group and Fire & Ice Sous Vide) and are seeking to engage with interested parties as widely as possible. Our research plan, commercialisation trajectory and progress to date will be outlined in the presentation.

PEER REVIEWED

## Session F4: Dairy direction

### Liangjue Lin

*Calcium- induced milk gels: effect of calcium source on rheological properties*

L. Lin<sup>a</sup>, M. Wong<sup>a</sup>, H. Deeth<sup>b</sup>, H. E. Oh<sup>a</sup>

Affiliation(s): <sup>a</sup>Massey Institute of Food Science and Technology, Massey University, Auckland

<sup>b</sup>School of Agriculture and Food Sciences, The University of Queensland, Australia

Milk gels can be produced by heat treatment, acidification or addition of rennet. The addition of soluble, ionic calcium may also result in gelation due to its effect on the structural changes of milk proteins. This study investigates the effect of adding various soluble calcium salts, calcium chloride, calcium lactate, calcium gluconate and calcium lactobionate, on the ionic calcium concentration, pH and rheological changes in skim milk. Calcium salts were added to reconstituted preheated skim milk. A Discovery HR-3, TA instrument rheometer was used to monitor the gelation. Ionic calcium concentration in solution was dependent on calcium salt added. At the same concentration of calcium addition, ionic calcium was found to be highest with calcium chloride > calcium lactate > calcium gluconate > calcium lactobionate. pH was observed to drop with addition of calcium, where pH drop was the greatest with calcium chloride and least with calcium lactobionate. Rheological measurements showed that higher concentrations of calcium lactobionate were required to induce gelation, followed by calcium gluconate, calcium lactate, and then calcium chloride. In summary, higher ionic calcium concentrations resulted in firmer milk gels.

PEER REVIEWED

### Carlos Augusto Fernandes de Oliveira, University of São Paulo,

*Biofilm-producing ability of Listeria monocytogenes isolates from cheese processing plants in São Paulo, Brazil*

Sarah H. I. Lee<sup>1</sup>, Giovana V. Barancelli<sup>2</sup>, Carlos H. Corassin<sup>1</sup>, Roice E. Rosim<sup>1</sup>, Adriano G. Cruz<sup>3</sup>, Carlos A. F. Oliveira<sup>1</sup>

<sup>1</sup>Department of Food Engineering, University of São Paulo, Brazil; <sup>2</sup>Department of Agroindustry, Food and Nutrition, University of São Paulo, Brazil; <sup>3</sup>Federal Institute of Education, Science and Technology at Rio de Janeiro, Brazil.

This study aimed to evaluate the biofilm production of *Listeria monocytogenes* strains isolated from 257 samples of cheese, brine and the environment of two cheese processing plants located in São Paulo, Brazil. Eighty-five *L. monocytogenes* isolates belonging to serotypes 4b, 1/2b and 1/2c were obtained and submitted to biofilm-formation assays on polystyrene microplates. All isolates were able to produce biofilms, with 40 (47.1%), 41 (48.2%) and 4 (4.7%) isolates classified as weak, moderate and strong biofilms producers, respectively. Peracetic acid (PAA, 0.5%) inactivation of biofilm formation by the four strong biofilm producers on polystyrene microplates and on stainless steel coupons was also investigated. Biofilms formed on stainless steel were affected by PAA after 60 s, with almost 100% damaged cells within 180 s. In polystyrene microplates, PAA decreased ( $P < 0.05$ ) the biofilm mass produced by the four *L. monocytogenes* isolates at 60 s, when compared with controls (no PAA treatment). However, PAA did not completely eliminate *L. monocytogenes* cells in polystyrene microplates, decreasing 2-3 log cycles after treatment with PAA for 180 s. Results of this trial warrants concern about biofilm-producing ability of *L. monocytogenes*, and stress the need for

stringent hygiene practices to prevent biofilm formation in the dairy environment. Further studies are necessary to determine the ideal PAA treatment to completely eliminate biofilms of *L. monocytogenes*.

PEER REVIEWED

**Richard Archer, Massey University**

*Dairy Research Trends*

Abstract not available

## Session G1: Navigating the Listeria challenge

**Lisa Olsen, MPI**

*Requirements under the Animal Products and Food Act*

Food contaminated with *Listeria monocytogenes* can cause the illness listeriosis. This can be a severe illness leading to death in vulnerable consumers. While severe cases of listeriosis are not common in New Zealand (about 25 reported annually), the outcome of a severe infection can be significant, and 20 to 30% of those who become ill may die. It has been found from investigating outbreaks that the main cause of listeriosis is the consumption of ready to eat (RTE) food contaminated with large numbers of *L. monocytogenes*. These are typically RTE foods that allow *L. monocytogenes* to grow, are stored at refrigeration temperatures and have a long shelf-life. This presentation provides an overview of the law that applies to processors of RTE products for the management of *L. monocytogenes*.

**Duncan Lash, MPI**

*The Butchers' Case Study*

As part of a review of the Animal Products Notice: Specification for Products Intended for Human Consumption 2016, MPI developed and consulted on requirements for Listeria control under the Animal Products Act. Requirements focus on processing of certain ready to eat products made from animal products (excluding dairy) by Risk Management Programme (RMP) operators. There are staggered implementation dates for the new requirements. There are also specific requirements for Dual Operator Butchers (DOBs). Implementation of the requirements for DOBs is being underpinned by operational research, engagement with the sector, and consultation to facilitate introduction of the new requirements. This presentation will outline the new requirements for RMP operators, and will then focus on the specific requirements for DOBs.

**Speaker TBC**

*A processor's experience*

**Sally Hasell, MPI**

*Listeria monocytogenes: resources and support for processors*

Pathogen management with a focus on minimising and reducing *Listeria monocytogenes* contamination has been a key areas of work for the Ministry for Primary Industries in recent years. Effective management however requires that everyone associated with the production of ready-to-eat foods, in particular foods

with an extended chilled shelf life, to have an understanding of the risks of Listeria contamination and their role in minimising the potential for contamination to occur. For some there will be a need to demonstrate that they have appropriate training and are competent in the relevant aspects of Listeria management. To facilitate implantation of these requirements, a wide variety of resources are available or under development. The resources vary from videos to fact sheets and training courses.

## **Session G2: Following Instructions - Integrating compliance to build value**

**Anthony Stephenson, IAMT**

*Quality, Employee Safety and the Environment - where is the common ground?*

Having been involved with quality for over 60 years, environment for the past 40 years and Occupational Health and Safety for a similar time, it has been refreshing to finally see some movement towards management system integration as part of our standards committee deliberations. Part of the presentation will also look at issues surrounding ISO 22000 and related new works in the food safety sector. There will also be a look at a non ISO standard for integrated management systems. The reference to “Brunfelsia” is woven through the theme as is the opposite to “upsizing”. Will we fall into the same trap as with previous standards, in furiously writing policies, procedures, instructions and setting objectives (or KPI’s) to cover every eventuality? If not what is the minimum, we should do to make our “management” system cost effective?

Have we really yet come to grips with Hazard evaluation and Risk/Opportunity management tools? How far can we make safe many processes, whether under people or automatic control?

There is no question that the auditor of today and the future must not only understand the technology of the business but also be very business savvy. The author will present observations from practice in a number of diverse industries including the food sector.

The presentation will be deliberately controversial!

**Tony Rew, Genesis Energy**

*Agile approach to Integrated Management Systems*

Currently Genesis Energy uses a traditional hierarchical document structure that cascades from policies (Intent), Standards (Accountabilities) to Process Descriptions (Workflow). Over recent months the Quality team have engaged in evaluating a non-traditional, monolithic and siloed framework to documentation.

Historically business have developed a hierarchy of documents that dictated, or imposed the work flow and responsibility of other departments across the entire business. This practice is fraught with issues from resistance to change through to avoidance behaviours.

The Quality team at Genesis Energy are considering/proposing a paradigm shift to a fluid, user centric, approach to develop its integrated, business management system (BMS). Rather than using a ‘cookie cutter approach’ (Template) we are proposing to use the stakeholders existing departmental documents and evaluate them for the necessary compliance requirements.

Example: Health and Safety AS/NZS 4801 standard framework for element 1 through 9 has, in the most part, resulted in businesses creating a set of stand-alone,

element specific, documents that impose another set of practices onto the business. In our proposed approach the AS/NZS 4801 standard would be measured against existing business documents and practices for compliance. If required, in consultation with stakeholders, minor changes would be made to those documents. This gives stakeholders ownership and removes the resistance and avoidance factors.

### **Manuel Seidel, ecoPortal**

*Moving beyond compliance and 'box ticking' - implementing effective EHS management systems*

## **Session G3: Critical knowledge to improve food properties**

### **Laurence Melton, University of Auckland**

*Learning how food proteins and polysaccharides interact enables the development of new foods*

Knowledge of precisely how proteins and polysaccharides interact is fundamental for understanding food manufacture, encapsulation of bioactives and enzymes), nanotechnology as well as digestion. We have chosen to work on common food macromolecules -  $\beta$ -lactoglobulin, the major whey protein and commercially available pectins. Using them as model compounds we have discovered how 1)  $\beta$ -lactoglobulin exists as dimer, 2)  $\beta$ -lactoglobulin interacts with a range of pectins, 3)  $\beta$ -lactoglobulin interacts with various pectic oligo-galacturonic acids. Additionally  $\beta$ -lactoglobulin was converted into amyloid nanofibrils by heating or microwaving and by using one specific pectin the nanofibrils can be bound together to form nanotapes. Such nanostructures can be used as scaffolding for carrying drugs as well as food bioactives.

### **Cameron Craigie, AgResearch**

*Hyperspectral imaging as a tool to predict meat quality attributes of lamb loins*

Name(s) of author(s): Michelle Challies<sup>1</sup>, Cameron Craigie<sup>1</sup>, Marlon Reis<sup>1</sup>, Neil Clelland<sup>2</sup>, Tong Qiao<sup>3</sup>, David Ross<sup>2</sup>, Jinchang Ren<sup>3</sup>

Affiliation(s): <sup>1</sup> AgResearch Limited, NZ, <sup>2</sup> Scotland's Rural College, Edinburgh <sup>3</sup> Strathclyde University, Glasgow, UK.

Hyperspectral imaging (HSI) is a non-invasive sensor technology that combines spectral data with a spatial dimension resulting in a data "cube" - a 2D photograph with a spectral dimension for every pixel. Evidence suggests that HSI can predict some beef quality parameters at processing but little is known about its application to predict lamb quality parameters from external cut surfaces. This project aimed to identify whether 1) lamb loin pH, tenderness and colour can be predicted using HSI, and 2) if lamb loin pH, tenderness and colour can be assessed by HSI on external cut surfaces through a vacuum package.

Eighty lamb loins (*M. longissimus lumborum*) with fat cap removed were scanned with an HSI system (spectral range of 400-900 nm, Gilden Photonics Ltd., Glasgow, UK). Scans were collected from the top and bottom surfaces of each loin, with and without vacuum packing (Scoflex packaging, 250 x 300mm 90 micron vacuum pouches). The pH, tenderness and colour of loins was assessed using standard

reference methods. The correlation between spectral variables and meat quality parameters was evaluated using principal component analysis and support vector machine regression. Predictions for shear force, pH and colour from the top and bottom loin surfaces were achieved with R<sup>2</sup> values ranging from 0.29-0.65. Results indicate prediction performance may be improved by scanning lamb loin through a vacuum package. HSI shows real promise as a tool for quality assessment of lamb loins, but further research on a larger number of samples under commercial processing conditions is needed.

PEER REVIEWED

### **Michelle Yoo, Auckland University of Technology**

#### *Digestibility of functional foods*

New product development is currently focused on improving nutritional quality. Apart from some key micronutrients with known health benefits printed on the packaging, we rarely find in-depth information on health consequences of consuming a product. Evaluation of protein based on the requirement of our body and our ability to digest it, so-called, PDCAAS, is one of the gold standards to assess the quality of proteins. It is not widely used as part of the product development process to characterise foods. Digestibility should be studied to examine the breakdown of foods – whether a large portion of the functional ingredient is being digested and utilised adequately, or not. In this talk, digestive patterns of newly developed food products under simulated human conditions using *in vitro* digestion systems will be discussed. Results will include the breakdown of fatty acids, amino acids and starch quantified at each stage of digestion.

PEER REVIEWED

### **Lovedeep Kaur, Massey University**

#### *The role of SunGold Kiwifruit in protein digestion*

Name(s) of author(s): <sup>1</sup>Lovedeep Kaur\*, <sup>1</sup>Marion Irastorza, <sup>1</sup>Jian Cui, <sup>1</sup>Chanapha Sawatdeenaruenat, <sup>2</sup>Juliet Ansell, and <sup>1</sup>Mike Boland

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Recent studies by the Riddet Institute have provided clear evidence that green kiwifruit (*Actinidia deliciosa* var. ‘Hayward’) can enhance upper-tract digestion of a variety of food proteins. A new gold kiwifruit (*Actinidia chinensis* var. ‘Zesy002’), marketed as Zespri SunGold, contains a higher amount of the proteolytic enzyme actinidin than the conventional Gold variety (*Actinidia chinensis* var. ‘HORT 16A’). We postulated that the effect of Hayward kiwifruit previously observed on protein digestion would be replicated with SunGold fruit. A 2-stage model system was used to represent the stomach and small intestinal digestion of commonly consumed protein-based foods. A SunGold kiwifruit extract altered the digestion patterns of all digested proteins, as observed using SDS-PAGE. For some protein sources, protein degradation resulted in a substantially greater digestion of intact protein in the presence of SunGold kiwifruit than that observed after digestion with mammalian digestive enzymes alone. This indicates the role of SunGold kiwifruit as a digestive

aid. More validation of the results involving animal studies is warranted to confirm that the in vitro results are applicable in vivo.

PEER REVIEWED

## Session G4: Diversley Dairy

### **Brendan Haigh, AgResearch**

*Harnessing the natural benefits of milk in food products*

The New Zealand food and ingredient sector is renowned for its ability to produce high quality, safe and nutritious dairy based foods which appeal to consumers. Global competition is fierce and our strengths in this area are now being matched by a broader range of companies throughout the globe. There are opportunities to take the lead again. One area which has been identified is the export of foods with validated health benefits, ie health beyond the provision of nutrition alone. For such an approach to be successful, we need to take a different approach to the way we develop and manufacture our foods. Central to this is a switch towards manufacturing and processing which optimises the inherent health supporting qualities of our foods. Using dairy as an example, this presentation will discuss evidence which indicates that the way we manufacture our dairy products significantly alters the health benefits of dairy based foods. It will then address the question, how do we retain or enhance these natural benefits, while continuing to provide a safe, high quality and attractive product.

### **Alison Hodgkinson, AgResearch**

*Composition and properties of sheep and goat milk: opportunities for New Zealand*

The New Zealand dairy industry landscape is changing with growing niche industries based on goat and sheep milk. These alternative industries provide New Zealand with excellent opportunities to diversify our milk products and grow our international markets. The well-established dairy goat industry has built strong markets for nutritional formulations for infants and young children, exporting to more than 20 countries worldwide. The emerging dairy sheep industry is diversifying into a range of food products including cheese, yoghurt, ice-cream and nutritional formulae.

Goat and sheep milk both have unique properties and characteristics that differentiate their milks from cow milk. With funding from MBIE and MPI, AgResearch has targeted research programmes that are supporting the growth of these industries, with both on-farm and off-farm focused projects. These projects range from characterising milk composition, understanding the health and nutritional benefits of the milk and milk products, increasing milk production through feeding and practical farming solutions providing best practise for animal health and welfare.

An overview of the current dairy goat and sheep landscape will be presented along with examples of how research is supporting the growth of these niche industries.

### **Caroline Thum, AgResearch**

*Ruminant milk oligosaccharides: Sweet opportunities in complex milk sugars*

Caroline Thum<sup>1,2</sup>, Wayne Young<sup>1,2</sup>, Li Day<sup>1</sup>, Nicole C Roy<sup>1,2</sup>,

<sup>1</sup>AgResearch Grasslands, Palmerston North, New Zealand.

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

Ruminant milk contains complex oligosaccharides known to impact beneficially human gut microbial composition and function in early life. We have demonstrated that goat milk oligosaccharides can be fermented by infant-type bifidobacteria which can potentially benefit the maturation of infant's gut. Using a mouse model, we have also shown that prenatal consumption of goat milk oligosaccharides improves offspring's growth and the concentration of bifidobacteria in the gut. The mixture of complex oligosaccharides found in ruminant milk may allow an opportunity for creating infant-dedicated foods supplemented with natural compounds to improve gut development and maturation. The combination of probiotics and ruminant milk oligosaccharides is also a promising avenue for developing more effective gut health-promoting products; a smart synbiotic.

PEER REVIEWED

**Tanu Gupta, AgResearch**

*Food spoilage spore forming bacteria in dairy farm environment - A North Island perspective*

Tanushree B Gupta, Kevin Rouw and Gale Brightwell  
AgResearch, Palmerston North,

Huge investments are made to control bacterial contamination of the food chain but there are still challenges to overcome with respect to spore forming bacteria. Spore formers such as Clostridia and Bacillus are of particular concern as these are common causes of food spoilage. Spores of Clostridium and Bacillus species are ubiquitous and both the vegetative and the heat resistant spore forms can contaminate raw milk via sources along the whole dairy food chain e.g., water, soil, faeces, milking equipment etc. Milk with high spore counts disturbs the cheese making process which results in cheese unsuitable for marketing. Since majority of the New Zealand's economy is based on production of milk and dairy products, too high of a spore count can result in a reduced milk price for the producer as well as rejection of dairy products in national and international markets due to spoilage. Recently, studies have shown different evolutionary trends between food related and environmental strains of spore forming bacteria and highlight an urgent need to focus on the (re)emergence of spore formers in food. Further, due to the isolation of NZ from its overseas markets, NZ sourced Clostridium and Bacillus could differ to those described internationally. Therefore, it's imperative to investigate the main sources of contamination into our food. Our present study is aimed at surveying and characterising spore forming bacteria derived from farm dairy effluent from Waikato and Manawatu regions. We investigated the types of spore formers present in these samples using Shahidi- Ferguson Perfringens (SFP) with egg yolk agar media supplemented with polymyxin B (3mg/lit) and kanamycin (12mg/lit) and 16S rDNA PCR. 16S rDNA sequence consensus was used to check the phylogenetic relationship of the isolates from different samples. Our preliminary data showed a variety of Bacillus and Clostridium species present in the matrices tested. However, broader analysis and collection of more on-farm and dairy processing samples are being carried out to better understand the food spoilage risk and potential sources of contamination.

## Day 3: Speaker Abstracts

### Session H3: GMO Rumble in the Scientifically Enhanced Jungle

**Jonathon Hickford, Lincoln University**

*GM foods, human behaviour and fickle markets: A challenging recipe!*

Humans have been domesticating plants for at least 10,000 years: including the domestication/development of wheat, rice, maize and potato. For example, ancient Central-American farmers transformed the grass teosinte through selection (selective breeding) for rare but desirable variation (or traits), to produce the modern plant maize. This variation came about from natural mutation, natural genetic recombination, sexual reproduction and introgression of new genes, or variants of genes from related species.

As time progressed selective breeding was carried out with greater precision, but methods were also developed to increase genetic diversity, including the use of chemicals or radiation to induce new mutations in DNA. Humankind progressed from simply selecting what had been provided by nature, to deliberately driving genetic change, or as some see it now, 'playing God' with evolution.

Next the emerging recombinant-DNA techniques of the 1970s enabled scientists to cut gene sequences from the DNA of one organism and splice them into the DNA of another. This enabled the creation of further genetic diversity for use in breeding plants and signalled the dawn of the age of Genetic Engineering (GE). Within a decade it was predicted that changes could be made to plants to address problems with insect pestilence and provide herbicide resistance for weed control. These predictions have come true.

In 2015, about 12 % (179.7 million of 1.5 billion hectares) of cropping land world-wide produced GE crops (FAO, 2015; James, 2015) and GE varieties were commercially available for nine food crops. GE maize and soybean were the most widely grown GE crops.

In this presentation, some of the key milestones in the development of GE plants will be discussed and the underlying technologies described in a general/non-technical sense. Specific detail and arguments around the costs and benefits of the developments will be left to the speakers that will follow.

**Andrew Allan, Plant and Food Research**

*New breeding technologies for NZ's plant industries*

Despite an acceptance that New Zealand would allow, on a "case-by-case" basis, the development of genetically modified (GM) plants or animals, there has been no commercial release of such organisms in this country. This may have been an advantage – NZ's clean-green-image (CGI) gives us market opportunities. However, GM plants are now 15% of world agricultural value – a market sector in which NZ has no part to play.

The basis of the public's fear of GM has been studied, and can be attributed to three intuitions which are "transgressed" with such a product. One key trigger of these fears is the movement of DNA from one species into another. Two new breeding technologies will be discussed in this talk – rapid flowering for plant breeding, and gene editing. These techniques do not produce plants with "foreign DNA". I will discuss why we need these techniques, and what is the demand; the benefits verses

risks. Importantly, how does the HSNO Act treat these to new technologies? What does the future look like for NZs plant-based industries'?

## Session H4: Ways to improve R&D outcomes

**Georg Ripberger, Massey University**

*The science of Culinary Food Smoke*

Food smoking, despite being one of the oldest food processing technologies applied by humans (in excess of 30,000 years), remains more of an art than a science. Reasons for this are the complexity of the underlying pyrolysis process with its associated transport phenomena and also a shift in its application from preservation to enhancing flavour, where it has come under increased scrutiny due to the formation of carcinogenic polycyclic aromatic hydrocarbons, resulting in the industry moving towards liquid smoking (70 % in the US and 30 % in the EU). However, its unique ability to influence the multisensory perception of flavour by simultaneously affecting the food aroma, taste, visual appearance and texture makes it an ideal tool for altering organoleptic properties and adding value to foodstuffs.

This paper focuses on establishing the science of food smoking. It presents the intricate relationship between feedstock type/properties, pyrolysis conditions, and desired and non-desired compounds that have been derived from literature and pyrolysis experiments on radiate pine wood and Manuka. Particular emphasis is given to the pyrolysis mechanisms that give merit to the tunability of smoke generation, that is, the production of enhanced controllable flavour profiles, while minimising or preventing the formation of harmful products. It highlights the opportunity for research to advance the craft of food smoking into a fully-fledged science that enables the design of next generation food smokers that meet the high standards of the food industry.

PEER REVIEWED

**Graham Fletcher, Plant and Food Research**

*Pathogenic Vibrio bacteria: A New Zealand food safety risk or just a compliance risk?*

*Vibrio cholerae* (toxic and non-toxic), *Vibrio parahaemolyticus* and *Vibrio vulnificus* are bacteria that naturally occur in seawater. They can be concentrated by filter-feeding shellfish and can subsequently cause illness in shellfish consumers. Toxic *V. cholerae* has not been detected in New Zealand, and non-toxic strains only occur in low numbers and are therefore low risk. Around the world increasing numbers of foodborne illness are being attributed to *V. parahaemolyticus* and more stringent regulations for *Vibrio* are being promulgated for intra-country and international trade. *V. parahaemolyticus* and *V. vulnificus* are present in New Zealand waters and at times occur in high numbers in New Zealand shellfish but there have been no cases of illness from our commercially harvested shellfish. Our recent studies have quantified *Vibrio* numbers naturally present in New Zealand shellfish since 2010 and have identified water temperature, growing area and year class as major factors in determining numbers. Comparing results with an earlier study (1981-84) suggests an increasing prevalence and concentrations of *V. parahaemolyticus* in Pacific

oysters that may be related to global warming. Despite high concentrations of total *V. parahaemolyticus* regularly occurring during summer, strains containing pathogenic genes are rarely present. Unfortunately most jurisdictions do not distinguish pathogenic and non-pathogenic strains in *V. parahaemolyticus* regulations. High numbers of *V. vulnificus* occur only occasionally in New Zealand (perhaps every 6 or so years) and the concentrations vary with different shellfish-growing harbours. Despite New Zealand having no history of foodborne illness from *V. vulnificus*, our strains are similar to those causing foodborne illnesses and deaths in North America and we have had wound infections and deaths from the organism. Actual human health risk and current regulatory responses will be discussed.

### **Mikhail Vyssotski, Callaghan Innovation**

*Unexpected sources of valuable lipids for food for special needs*

While the current trend towards personalised diets is yet to be fully realised, a rapidly developing area of foods for special needs has already gained a foothold in top scientific research with topics like “Nutritional needs of military”, or “Dietary requirements of ageing population” seen alongside more established ones. A number of simple and complex lipids have been identified to be beneficial or potentially beneficial when administered to certain populations. Conventional sources do not always provide the target lipid components in sufficient amounts, or their use may not be justified (e.g., these products turn out to be prohibitively expensive), or could be undesirable (e.g., bovine-derived preparations). Nutritional value of lipids is steadily reassessed, and the development and advancement of analytical techniques leads to the discovery of novel components seemingly responsible for beneficial properties of dietary supplements in existence for decades. Studies performed at Callaghan Innovation and elsewhere reveal a range of new and/or underutilised sources of high value lipids. Here, some of the currently employed and potential sources, along with the relevant trends in the field of lipid nutrition, will be discussed.

The development of a lipid component of novel dietary supplements and functional foods involves determining the target, selecting an optimal feed, optimising the process, and assessing the quality of final product – all of these require both knowledge on the properties and distribution of lipids in nature, and an ability to perform advanced lipid analyses to ensure the presence of beneficial components and the absence of undesirable compounds.

PEER REVIEWED

### **Vidya Kethireddy, University of Otago**

*Pulsed Electric Field Processing - A tool to produce reduced sulphite wines*

This project explores the effect of Pulsed Electric Fields (PEF) on yeast inactivation and sulphite addition in winemaking. Defined grape juice medium and PEF processing condition effective for bioactive extraction were used. PEF led to significant lethal and sub-lethal injury of the spoilage yeast *Hanseniaspora uvarum* ( $P < 0.05$ ) at exponential phase. The important flavour developing yeast *Picchia kluverii* remained unaffected ( $P > 0.05$ ) and *Saccharomyces cerevisiae*, the most important fermentative yeast, was slightly reduced ( $P < 0.05$ ) initially after exposure, but the numbers quickly recovered. *S. cerevisiae* growth was unaffected by sulphite concentration ( $< 350$  ppm) while *H. uvarum* was inhibited at  $> 20$  ppm. At  $> 187$  ppm sulphite, the growth rate of *P. kluverii* slowed down during exponential phase. At stationary phase, combined PEF and sulphite (350 ppm) treatments reduced the

yeast growth more than either treatments. Growth phase of yeast was the most important factor determining the efficiency of PEF or its combination with sulphites.

## Session I3: GMO Rumble in the Scientifically Enhanced Jungle

**Jack Heinemann, University of Canterbury**

*Genetic engineering in agriculture and food production: what is a GMO? What are the risks for New Zealand?*

Carrying on from the introduction to the history and present of genetic engineering provided by Prof Hickford, and applications of the techniques, especially new techniques, by Dr Allan, I'll present a view of the near future. This view will consider how various jurisdictions have framed through definition and practice the concept of a regulated organism derived from genetic engineering. Both the science 'semantics' of the definitions and the history of interpretation by regulators is likely to influence what in the future we call a GMO.

This talk will mainly focus on the history of regulatory systems in Europe and the United States, because these have the longest histories and most regulatory frameworks in the western world are homologous (in the proper sense) to one of these. However, reference will also be made to recent developments in New Zealand.

These frameworks will have effects on how we conduct risk assessments, mainly because they will determine what products are subject to risk assessments. Importantly, though, they will also influence how decision makers receive and perceive evidence of harm and benefit. This too will be briefly discussed.

## Session I4: Growing great ideas

**Bob Hamilton, Earlee Products**

*Extending Shelf Life*

Foods that were once managed through the addition of traditional preservatives are now managed with new shelf-life technologies. Shelf life will be defined and aspects that influence it including physical, chemical, and microbial changes will be discussed. Traditional methods for extending the shelf life of foods will be detailed including benefits to manufacturers. The purpose and function of additives will be discussed with a focus on reasons for consumers' lack of understanding. Hurdle Technology offers unlimited alternatives to meet consumer demands for healthy and safe foods. Small goods particularly can be preserved by means such as Hurdle Technology allowing us to enjoy the best of food for a much longer time than nature would normally permit. Earlee Products have found several suitable, well established, natural food ingredients with dual functionality including anti-microbial properties which act as natural shelf life extenders preventing the growth of spoilage and pathogenic bacteria, including *Listeria monocytogenes*.

**Sravani Gupta**

*Does frozen storage eliminate food safety risk from oysters affected by increases in seawater temperature?*

Oysters are filter-feeders and are often consumed raw, producing a combined risk for oyster consumers, as:

1. Any pathogenic bacteria present in harvesting waters are concentrated in the oyster

2. Raw consumption means that pathogenic bacteria are not killed by cooking. *Vibrio vulnificus* can be naturally present in marine environments in which oysters grow. It lives in warm seawater and causes open wound infections, gastroenteritis and can cause septic shock in immuno-compromised individuals. The optimum growth temperature for *V. vulnificus* is 37°C, with a range of 8-43°C. Thus, increases in New Zealand seawater temperatures favour the growth and accumulation of *V. vulnificus* in oysters. We tested whether simple postharvest intervention processes (blast freezing and frozen storage) could ensure safe edible oysters. Pacific oysters artificially contaminated with a known dose of *V. vulnificus* were blast frozen at -55°C and stored frozen for up to 150 days at -18°C. We performed six trials using different sampling times: 0, 1, 30, 45, 60, 90, 120 and 150 days. On each sampling day *V. vulnificus* numbers were enumerated using a Most Probable Number (MPN) method. The inoculated oysters had an average bacterial reduction of 0.84 log<sup>10</sup> MPN from Day 0 to Day 1 as a result of blast freezing. *V. vulnificus* numbers declined log-linearly during frozen storage, usually achieving the target reduction of 3.52 log<sup>10</sup> within 90 days. Blast freezing followed by frozen storage could be an effective simple postharvest intervention technology to achieve food safety.

PEER REVIEWED

### **Tony Mutukumira, Massey University**

*Water kefir beverage: a new generation of fermented drink*

Nowadays, health awareness among the consumer has grown and boosted the demand for foods that promote good health such as functional foods with probiotics. Water kefir is a refreshing, sparkling fermented beverage with an acidic, sweet, slightly alcoholic taste, and a yeasty flavour. Water kefir fermentation can be achieved by the addition of kefir grains as a starter culture into a solution containing fermentable sugar. The kefir grains comprise of a symbiotic starter culture of lactic acid bacteria and yeasts contained in a polysaccharide matrix called kefiran. The unique flavour of the fermented beverage is a consequence of the symbiotic metabolic activity of several lactic acid bacteria and yeasts which metabolise the sugars into volatile and non-volatile aromatic organic compounds such as lactic acid, acetic acid, ethanol, carbon dioxide, ethyl hexanoate, ethyl octanoate, and other flavour compounds. Kefir grains are categorised as probiotics which confer beneficial effects on maintaining human health, promoting wellness, and reducing the risk of diseases such as diarrhoea and colon cancer. At present, there is interest in using kefir grains in water-based fermentations which provide alternatives for the delivery of probiotics. The fermentation produces natural carbonation and lower sugar levels, thus they may be considered to be healthier than currently commercial soft beverages. Previous studies have focused on identification and microbiological composition of kefir culture responsible for fermentation using a wide range of microbiological and molecular approaches. Therefore, information on kefir fermentation of water-based beverages is lacking.

### **Shakeel Ahmed and Lukas Svoboda, iMonitor**

*Predicting food quality in real-time and potential benefits*

iMonitor Ltd has developed APRI – a real time cold chain monitoring service. This service records temperature, humidity and volatile cornerstone data which can be accessed by any stakeholder remotely.

A novel application of APRI is prediction of organoleptic shelf life of food products using Taguchi's quality principles. Taguchi's principles are statistical methods used to describe quality of goods, manipulated to show quality loss of carrots.

In this study carrots were stored in a simulated cold chain expected in a typical farm to supermarket scenario. Cornerstone data was collected by APRI and readings of quality characteristics (weight, colour and texture) were taken on day 0, 7, 14, 21.

This data was integrated with cornerstone data, analysed with Taguchi quality loss function to determine the percentage impact of cold chain on quality characteristics.

A predictive food quality model was built using this data. The parameters were arranged in an array, the quality characteristics were calculated based on combinations of cornerstone data and found to be in agreement with observed data with a regression relationship of 0.93.

This approach was shown to predict the shelf life of carrots in a simulated cold chain and the percentage impact of different stages of cold chain accurately.

Implementation of shelf life prediction within APRI helps quantify the impacts of the cold chain on food quality, shelf life and increase transparency. This helps iMonitor clients reduce waste and lower risks associated with food safety, optimize sales and storage based on shelf life.

PEER REVIEWED

# Student Poster Competition Abstracts

**NB All abstracts have been Peer Reviewed.**

## **S1: Abbey Symes, University of Otago**

*Antioxidant activities of New Zealand asparagus root*

Name(s) of author(s): Abbey Symes\*, Aladin Bekhit, Amin Shavandi  
Food Science Department, University of Otago

Asparagus root (*Asparagus officinalis*) has been used in Ayurveda and traditional Chinese medicine. The roots contain beneficial bioactive compounds, including antioxidants and anticarcinogenic compounds. Every 20-40 years, asparagus fields are resown and the viable roots discarded, leaving a potential source of valuable and unique bioactives that could be utilised in pharmaceutical and biotechnological applications, to waste. New Zealand asparagus roots have not been characterized or investigated and there is no information on the contents of their bioactive compounds. Therefore, this project aims to investigate the antioxidant activity of New Zealand asparagus roots.

The total polyphenols, total flavonoids and the antioxidant activities will be determined using ethanol and methanol at various concentrations.

Key words: Asparagus Root, Pulsed Electric Field, Ionic Solvents, Bioactive Compounds

## **S2: Adam Rowe, University of Otago**

*Characterisation of volatile organic compounds in New Zealand honey*

Name(s) of author(s): Adam Rowe, Graham T. Eyres and E. John Birch  
Department of Food Science, University of Otago

New Zealand honey is some of the most desired in the world with substantial export value to New Zealand producers. With this growing industry a greater understanding of the volatile organic compounds (VOCs) in New Zealand honey could be useful in developing and promoting the benefits in regards to flavour and quality.

Pilot testing was carried out on three varieties of New Zealand unifloral honey (manuka, thyme and honeydew) using solid phase micro extraction (SPME) and analysis with gas chromatography mass spectrometry (GC-MS).

Analysis of the samples by GC-MS determined the presence of 45 VOCs in the manuka and thyme samples and 57 in the honeydew sample. A tentative identification was achieved for 58 of the VOCs which showed that the thyme sample was dominated mainly by aldehydes but also a large amount fatty acids and alcohols. The manuka and honeydew samples were found to have much less of these VOCs but a much more diverse range of VOCs than the thyme sample.

The compounds found that could be used to differentiate between the three honey types were benzaldehyde, ethanol, d-limonene and octanal for honeydew. Manuka contained dimethyl sulphide, and dill ether. Thyme was characterised by 2-heptanone, 2-nonanone, p-cymene, nerol oxide, propanoic acid and (E)-3-hexenoic acid.

## **S3: Amie Duan, University of Auckland**

*The development of gluten-free biscuits enriched with antioxidants and dietary fibre*

Name(s) of author(s): Amie Duan and Siew Young Quek  
The University of Auckland

Coeliac disease has become prominent over the last few years as a result of better diagnosis and awareness. The increase towards this gluten allergy and inspiration from my supervisor encouraged my New Product Development project to develop a snack product accompanied by a questionnaire facilitated by the organisation Coeliac New Zealand. The results of this questionnaire determined what supermarket products Coeliac Disease individuals wanted to see more of. This led to the development of a gluten-free biscuit enriched with functional food ingredients, antioxidants (*Lycium Barbarum* commonly known as goji berry) and dietary fibre (Fibersol-2® a brand of resistant maltodextrin).

Gluten-free control biscuits were prepared from rice and starch flours, and enriched biscuits were prepared with antioxidant and dietary fibre in a controlled laboratory. The gluten-free biscuits were enriched with different levels of goji berry (5%, 8%, 15%) and a constant level of dietary fibre (3%). All biscuits were evaluated for their physical, textural, colour, antioxidant activity using DPPH free radical-scavenging and ABTS methodology, water activity and sensory attributes following a consumer test. Alongside these, the control and 15% enriched biscuits were evaluated in an accelerated shelf life test (ASLT) held at room temperature (21°C) and 31°C ambient over four months.

Overall the results indicated that gluten-free biscuits enriched with antioxidant and dietary fibre provided a more structurally sound texture, and withstood 31°C ambient storage when subjected to ASLT compared to the control biscuits. Furthermore, the deterioration rate of the total antioxidants were similar between the ambient temperatures.

#### **S4: Amrita Doe, University of Otago**

*Reduction of food waste through menu alterations*

Name(s) of author(s): Amrita Doe & Miranda Miroso

Affiliation(s): Department of Food Science, University of Otago

According to the Food and Agricultural Organization, 30-50% of all food produced on the planet is wasted. Statistics show that New Zealanders are eating out more frequently, and consequently generating more out-of-home waste. Therefore food waste preventative measures are needed in the hospitality sector. The aim of this study was to investigate menu alterations in restaurants and cafes in order to reduce out-of-home food waste. In particular, this study aimed to provide information to implement a community based social marketing campaign, promoting change.

In order to identify the barriers and benefits to menu alterations in the hospitality sector four main steps were undertaken: (1) analysis of New Zealand survey data concerning current practices and attitudes towards menu alterations; (2) semi-structured observations in restaurants and cafes, exploring consumer's food waste behaviours; (3) focus groups to further inspect reasons for consumer's behaviours and attitudes regarding menu alterations, as well as suggestions to change this perception; (4) to trial these new suggestions in a real-life setting.

The results indicated that there are two barriers affecting food waste: internal and external. The internal factors related to the individual, including feeling embarrassed about asking for a smaller portion size. External factors included those that the restaurant or café did not carry out, such as lack of offering different sized meals. In conclusion, menu alterations are welcomed among consumers and if

hospitality establishments adopt these menu alterations, they allow for an increase in clientele as well as enhanced positive image among consumers.

#### **S5: Caitlin Croft, University of Otago**

*Characterisation of polyphenols in central Otago Rosehips.*

Names of authors: Caitlin Croft, John Birch\*

Affiliation: Department of Food Science, University of Otago

Wild rosehips and leaves have the potential for providing a good source of antioxidant polyphenols. *Rosa canina*, or dog rose, is found throughout Central Otago and is often seen as an invasive species. Currently in New Zealand, rosehips are collected and used as a feed supplement for livestock, and in small batch production of jams, nectars and teas. Rose hips contain a high level of ascorbic acid and previous study has determined that the phenolic fraction of the rose hip also has strong antioxidant capabilities. However the phenolic profile has yet to be determined for the Central Otago roses. In this study, the characterisation of the polar fraction phenols from wild-grown rosehip hypanthium (flesh), seed and leaves, using High Pressure Liquid Chromatography (HPLC), will be conducted. Powdered, dried samples will be added to diluted ethanol. Ultrasound treatment will be used to aid in the extraction of the polar fraction of the samples at a range of times and temperatures to optimise phenol extraction. Total phenolics will be analysed using the Folin-Ciocalteu assay and HPLC will be run to identify and quantify compounds. Fractionation and efficacy testing of the compounds identified will then be conducted with the use of antioxidant assays. There is potential for Otago rosehips, a current waste product, to become a high profit product for use in oils as a preservative and in health supplements.

#### **S6: Chia Ying Tey, University of Auckland**

*Study of enzyme inactivation and quality change of defatted avocado puree treated by thermal treatments*

Name(s) of author(s): Chia Ying Tey<sup>a</sup>, Linyan Zhou<sup>b</sup>, Gokhan Bingol<sup>a</sup>

Affiliation(s): <sup>a</sup>Chemical and Materials Engineering, University of Auckland

<sup>b</sup>Institute of Food Science and Technology, Beijing

Defatted avocado puree (DAP), which is a by-product of extraction of avocado oil, is generated in huge amounts and disposed as waste due to enzymatic browning, which is caused by polyphenol oxidase (PPO), which significantly limits its shelf life. However, DAP can be used in cosmetic industry and has the potential as a supplement to health products. Thus, inactivation of PPO is crucial to extend shelf life of DAP.

In this research, to inactivate PPO we have investigated two thermal, namely microwave (MW) at 11.0 W/g power density for 80s and conventional heating (CH) at 85°C for 5 min; and one non-thermal technology, namely dense phase carbon dioxide (DPCD) at 12% CO<sub>2</sub>, 5000 psi and 40°C operating temperature. Furthermore, the samples were stored at 4°C for 4 weeks for shelf life studies.

It was found that MW treatment resulted in 85.3% reduction in PPO activity whereas DPCD and CH provided a reduction of 37.9% and 10.4%, respectively. Therefore, for shelf life studies only MW treated samples were used. It was observed that most of the inactivation of PPO was achieved when sample temperature rose approximately to 90°C. The residual PPO activity during the storage for untreated sample increased to 282.5%; whereas for MW treated samples it remained under 20%. At the end of

storage, MW treated samples had considerably higher chlorophyll a and b (46.20 and 130.99%) and total phenolic (29.41%) contents and higher antioxidant capacities (19.47%) than control samples with a total colour change of 2.74.

### **S7: Da Chen, University of Auckland**

*Why does celery stick in your teeth?*

Da Chen<sup>a</sup>, Philip J. Harris<sup>b</sup>, Laurence D. Melton<sup>\*a</sup>

<sup>a</sup> School of Chemical Science, Faculty of Science, The University of Auckland

<sup>b</sup> School of Biological Science, Faculty of Science, The University of Auckland

Collenchyma cells make up the fibres that get stuck between your teeth when you eat celery. We are interested in how these cells differ from the other softer parenchyma tissue from the point of view of cell wall polysaccharides. The cell walls are the main contributor to the mechanic strength and hence the texture. The celery collenchyma strands run from base to the top of celery stalks with a significantly smaller cross-sectional area. Celery stalks were found to elongate throughout their lengths when young, but as mature, elongation was found to be increasingly confined to the top, until elongation ceased. Bright field light microscopy and environmental scanning electron microscopy showed the cell number and average cell area decreased from bottom to top, where the wall thickness increased. The cell wall (CW) composition showed nearly 30% cellulose, 55% pectins and 15% hemicelluloses in collenchyma. After extraction of the pectin rich and hemicellulose rich components, it was found that the pectin had a higher degree of esterification and there were more hemicelluloses in the top region. Additionally, solid state <sup>13</sup>C nuclear magnetic resonance (NMR) spectrometry indicated distinct mobility of polysaccharides in the three regions, which was in accordance with their mechanical properties.

### **S8: Dayna McCormick, Massey University**

*Sensory characteristics of vanilla extracts*

Name(s) of author(s): Dayna McCormick, John Grigor, Wannita Jirangrat, Marie Wong.

Affiliation(s): Massey University, Auckland.

Vanilla beans are grown in a variety of tropical locations worldwide and can be extracted with ethanol to create a vanilla flavour extract. Using a qualitative descriptive analysis (QDA) trained panel, commercially available vanilla extracts were tested to determine the aroma and flavour profile of each extract. Based on seven aroma attributes and nine flavour attributes, it was found that the sensory profiles of the vanilla bean extracts differed depending on the location of bean origin. Principal component analysis (PCA) revealed that the extracts were grouped according to the country that the beans were grown in, and this was confirmed using hierarchical cluster analysis. Vanilla extracts originating from different growing regions can be differentiated using a trained sensory panel.

### **S9: Guantian Li, University of Auckland**

*Amylopectin fine structure in relation to physicochemical properties of quinoa starch*

Name(s) of author(s): Guantian Li, Dr. Fan Zhu

Affiliation(s): University of Auckland

Quinoa (*Chenopodium quinoa* Willd.) is a pseudocereal of Andean origin. In recent years, there has been growing interest in quinoa in part due to its functional properties and nutritional value. Starch is a major component of quinoa seed and its physicochemical properties have been investigated among 26 samples. Quinoa starch, like other starches, consists of two types of biomacromolecules: linear amylose and branched amylopectin. Amylopectin has been found to be the major component of quinoa starch (accounts for 91.6%-93.9%). The aim of this work is to unveil the relationship between the structure of amylopectin and physicochemical properties of quinoa starch. To achieve this goal, amylopectin was isolated from the selected starch samples and then partially hydrolysed to  $\phi$ ,  $\beta$ -limit dextrin by phosphorylase a and  $\beta$ -amylase. Amylopectin and  $\phi$ ,  $\beta$ -limit dextrin were debranched before being analysed by High Performance Anion-Exchange Chromatography coupled with Pulsed Amperometric Detection system (HPAEC-PAD). Results show that external and internal structure of amylopectin significantly correlates on starch properties such as gelatinization properties, crystallinity, enzyme sustainability and pasting properties. This suggests that both the external and internal parts of amylopectin are critical to the physical behaviour of quinoa starch. This work provides information for the prediction of starch properties from structure information in a certain extent and possibility of precisely tailor starch for diverse food and non-food uses.

#### **S10: Hui Ye, University of Canterbury**

*The effects of fermentation on isoflavones in tofu and sufu manufacture*

Hui Ye & Ian C. Shaw

University of Canterbury

Introduction: Phytoestrogens comprise a diverse group of plant metabolites which have different estrogenicities according to their degree of 17  $\beta$ -estradiol molecular mimicry. Soybean-based foods are important dietary sources of phytoestrogens (isoflavones). Isoflavones have both health risks and benefits; e.g., colon, and endometrial, but are also implicated in the decrease in human sperm quality. Fermentation processes used in food manufacture might biotransform isoflavones with concomitant implications for food-related health effects.

In this study, the biotransformation of the soy isoflavones glycosides, genistin and daidzin and their aglycones, were investigated during tofu and sufu manufacture.

Methods: Tofu is made by soaking and grinding soybeans in water to make soymilk, coagulating (heat or  $\text{CaSO}_4$ ) the soymilk, then pressing the curds into blocks.

Samples were collected at each production step, methanol extracted, centrifuged, filtered, and HPLC analysed.

Sufu is fermented tofu. Commercial sufu production uses specific fungi/bacterial, whereas homemade sufu uses naturally occurring microorganisms. Samples were taken at each production steps for sufu and analysed as for tofu.

Result: Tofu: isoflavone levels decreased following soaking and grinding with further reduction following heat. Isoflavone levels increased after  $\text{CaSO}_4$  coagulation.

Sufu: isoflavone glucoside levels decreased markedly following fermentation with a concomitant increase in isoflavone aglycones. Salting slightly increased these two forms. There were differences in isoflavone compositions of homemade and commercial sufu.

Conclusions: Fermentation liberates isoflavone aglycones from their corresponding glycosides, and protein coagulation releases protein bound isoflavones and their glycosides. This might have implications for health-related functionalities of fermented soy-based foods.

### **S11: Ivy Caixia Gan, University of Auckland**

*Consumer trust in high involvement food brands: an exploratory study of infant formula consumption in urban China*

Name(s) of author(s): Ivy Caixia Gan, Denise M. Conroy, Michael S.W. Lee

Affiliation(s): The University of Auckland Business School

Food products and food quality are crucial in everyday life. It is believed that the delinking of consumers and food production systems creates uncertainty and fear (Fischler, 1980), and the potential risks involved in modern food systems have increased the research of trust in food (e.g., Kjærnes, Harvey, & Warde, 2007). However, a review of existing literature indicates a lack of understanding of consumer trust in relation to how consumers experience the evolving trust development with high-involvement food brands, particularly after food scares. This work is the first part of a longitudinal study on consumer trust in high-involvement food brands, in the context of infant formula consumption in urban China. From in-depth interview with 25 first-time pregnant women from four major cities of China, this work explores how prospective mothers select their intended infant formula brands for future infant feeding, and explores the social construction of consumers' trust in such a high-involvement food category. As trust is a context-specific construct (Mayer, Davis, & Schoorman, 1995), the preliminary findings of this empirical work highlight how Chinese parents' trust in infant formula brands is socially constructed within their social-cultural background, and provides insights different from previous research conducted in western markets. A follow-up study will be undertaken in 6 months in order to explore how the new parents' trust in their intended infant formula brand has developed, and how consumers' trust in infant formula brands impacts their brand selection and consumption over time.

### **S12: Jade Chia, University of Otago**

*Evaluation of protein and mineral profiles in sheep milk*

Authors: Jade Chia<sup>1\*</sup>, Aladin Bekhit<sup>1</sup>, Li Day<sup>2</sup> and Linda Samuelsson<sup>3</sup>

Affiliations:

<sup>1</sup>University of Otago

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Sheep dairy in New Zealand is an emerging industry with a high prospect of developing niche and highly nutritious sheep milk products. Minerals obtained from the diet play an important positive role in human health and well-being as they contribute to bone health and to various metabolic processes. To date, research has been conducted on sheep milk cheeses, but little is known about the mineral and proteins composition of New Zealand sheep milk. This project has focused on understanding the relationship between the concentration of nutritional minerals and proteins including the caseins ( $\alpha$  s1-casein,  $\alpha$  s2- casein,  $\beta$ -casein,  $\kappa$ -casein) and whey proteins including ( $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin and lactoferrin) in sheep milk. A total of 30 milk samples from individual sheep at early and mid-lactation from two New Zealand farms were analysed for mineral content, using

Inductively Coupled Plasma Optical Emission Spectrophotometry, and protein contents using high performance liquid chromatography. The relationship between the concentrations of nutritional minerals and the profile of caseins and whey proteins will be discussed. This study indicates that sheep milk has considerable value and applications in the development of nutritional foods, and further supports the expansion of sheep dairying in New Zealand.

**S13: Jamie Scrimgeour, University of Otago**

*Impact of fermentation parameters on hop derived aroma compounds in beer.*

Name(s) of author(s): Jamie Scrimgeour, Graham Eyres, Tobias Richter, Pat Silcock, Phil Bremer

Affiliation(s): University of Otago, Food Science Department

With the recent boom in craft beer consumption and the increased consumer demand for hoppy and flavourful beers, more brewers are looking for ways to get the most out of their hops. One aspect of the brewing process that is not well understood is the relationship between yeast fermentation conditions and their impact on the hop derived aroma compounds in finished beer.

Three yeast pitching rates (Low, Standard, and High) and three fermentation temperatures (16°C, 20°C, 24°C) were tested for their impact on volatile compounds in beer and analysed by Gas Chromatography coupled with Mass Spectrometry and Head Space Solid Phase Micro-extraction. Two hopping regimes (no late hopping and a 5 min boil) were used in order to determine key hop derived compounds. This project aims to help brewers better understand their yeast and provide insight on how a single yeast strain can be optimised to produce a range of hop flavour profiles in beer. This knowledge may be useful for breweries who use only one or two yeast strains to improve the desired hoppyness of different beer styles using a single yeast. Based on the results of these initial experiments a second stage of this project will include sensory testing using a trained panel to compare how these analytical differences relate to the perceived flavour profile of the final product.

**S14: Meghan Treadwell, University of Otago**

*Effect of Pulsed Electric Field processing on the maceration time required for red wine grapes*

Authors; Treadwell M<sup>1</sup>, Liu T<sup>1</sup>, Hochberg M<sup>2</sup>, Sack M<sup>2</sup>, Müller G<sup>2</sup>, Oey I<sup>1\*</sup>

<sup>1</sup>University of Otago, Dunedin

<sup>2</sup>Karlsruhe Institute of Technology, Germany

Pulsed Electric Fields (PEF), a processing technique where high voltage is applied to the sample over a very short period of time, can enhance phytochemical extraction from plant cells. In traditional red wine making, a long maceration time is required to extract anthocyanins and phenols due to thick cell walls. The aim of this research is to study the effect of different PEF parameters on the extraction of phytochemicals from red wine grapes during different lengths of maceration time. The grapes were destemmed and pumped through continuous PEF equipment at 500 kg/hour. Exponential pulses were applied at varying levels of electric field strength (25 and 33 kV/cm) and frequencies resulting in different specific energy inputs ranging from 9 to 49 kJ/kg. The grape must was collected in tanks and samples were taken daily until day four of maceration. The samples were then tested for brix, conductivity, colour intensity, total anthocyanin content and total phenolic content.

Results showed that higher PEF energies enhanced anthocyanin and phenol release, as also observed with increasing colour intensity. This change is significant compared to untreated samples. The highest colour intensity of PEF treated samples was achieved after 2 days or more of maceration for untreated samples. PEF increased the conductivity of grape must indicating that electroporation occurred and phytochemicals were released. This trend continued for the first two days of maceration.

In conclusion, PEF treatment can enhance the extraction of anthocyanins and phenolic compounds thus decreasing the time required for maceration.

#### **S15: Pei-Huan Hsieh, University of Auckland**

nanotech optical sensors for the detection of adulterants using Surface Enhanced Raman Spectroscopy (SERS)

Name(s) of author(s): Pei-Huan Hsieh (presenter), Dongxiao Sun-Waterhouse and Geoffrey I.N. Waterhouse

Affiliation: The University of Auckland.

Global concerns about food and beverage quality and safety motivate the development of advanced analytical techniques for the selective detection and quantification of adulterants. Surface Enhanced Raman Spectroscopy (SERS) has attracted much attention in this regard, due to its high sensitivity for low concentration analytes. In this research, we explored the fabrication, characterisation and application of novel three-dimensionally ordered macroporous SERS substrates (Au/3DOM TiO<sub>2</sub>) which demonstrate superior SERS activity compared to conventional 2D substrates. A series of photonic-crystal based SERS substrates with different gold loadings were fabricated, then characterised by a range of techniques including SEM, TEM, XRD, UV-Vis angle study and XPS to detect their structural and optical properties. The Au/3DOM TiO<sub>2</sub> substrates fabricated in this work demonstrated excellent SERS activities with the enhancement factors of 10<sup>7</sup>-10<sup>10</sup>, enabling the detection of aqueous melamine at concentrations as low as 10<sup>-3</sup> mM. The various pH-dependent forms of melamine were also discernible in the SERS spectra. The reusability result confirmed Au/3DOM TiO<sub>2</sub> can be reused after photodegrading adsorbed analytes without significantly losing SERS activity. In addition, these same SERS substrates can also be used for the determination of solvent refractive index (e.g. the soluble solids in juices) via two different optical mechanisms, confirming their versatility as multi-functional optical sensing platforms.

#### **S16: Quan Yuan, Massey University**

*Formation of nano- and microemulsions by the dilution of emulsions: Effect of oil and surfactant type*

Name(s) of author(s): Quan Yuan, Sung Je Lee and Marie Wong

Affiliation(s): Massey University, Auckland

Nano- or microemulsions contain small particles less than 100 nm or 50 nm in diameter. The optical properties of these emulsions tend to be translucent or transparent with the potential for their application in clear water or soft drinks. In this study, nano- and microemulsions were prepared by the emulsion dilution method involving a dilution of conventional emulsions prepared by high pressure homogenization into an aqueous micellar solution of small molecule surfactants. Different types of oils (lemon oil, peanut oil, isopropyl myristate) and surfactants

(Tween 20, 60 and 80) were utilized to investigate their effects on the formation of nano- or microemulsions. The results showed that lemon oil was the most efficient when fabricating nano- or microemulsions by the emulsion dilution method due to its small molecular size and low viscosity. On the other hand, triglyceride oils could not form nano- or microemulsion by this method because of their large molecular size and high viscosity. In addition, the amount of oil being incorporated into surfactant solutions to form nano- and microemulsions was also affected by surfactant type and concentration. Tween 60 had the highest oil drop solubilisation capacity compared to other types of Tween surfactants. In conclusion, the emulsion dilution method can be used to produce nano- and microemulsions, however, the methods have some limitations with certain types of oils and surfactants.

#### **S17: Quan Yuan, Massey University**

*Properties and stability of oil-in-water emulsions: Effect of emulsifier type*

Name(s) of author(s): Quan Yuan, Sung Je Lee and Marie Wong

Affiliation(s): Massey University, Auckland

In this study, three different types of emulsifiers, sodium caseinate, gum arabic and Tween 80, were compared and evaluated for their emulsifying capacity and emulsion stability. Oil-in-water emulsions containing 5, 10 and 20% soybean oil were prepared at different emulsifier concentrations (0.5, 1 and 2%) by high pressure homogenization. The results indicated that emulsifying capacity and properties differ between the three emulsifiers. Tween 80 or sodium caseinate resulted in small oil droplets (< 200 nm) whereas gum arabic emulsions had relatively large oil droplets (600 nm), resulting in rapid creaming after preparation. Tween 80 emulsions remained stable against droplet aggregation after preparation, regardless of Tween 80 concentration. However, sodium caseinate emulsions prepared at 2% emulsifier exhibited creaming during storage, possibly due to depletion flocculation. Emulsions were also prepared and analysed for changes in particle size and stability against heat treatment, pH change and salt addition. Heat treatment had no significant influence and all emulsions remained stable with no notable change in particle size. Change in pH and NaCl addition had no effect on Tween 80 emulsions whereas emulsions stabilised by sodium caseinate had droplet aggregation and phase separation at pH 3-5 but were not affected by NaCl. The addition of NaCl or pH change (pH 3-4) resulted in an increase in the particle size and creaming of gum arabic emulsions. The study provides insight into the formation, properties and stability of emulsions that could be affected by types of emulsifiers used.

#### **S18: Quan Yuan, Massey University**

*Antimicrobial effects of ingredients of commercial toothpaste on growth of some human oral bacteria strains*

Name(s) of author(s): Quan Yuan, Rachel Liu, Anthony N Mutukumira

Affiliation(s): Massey University, Auckland

Seven main ingredients (peppermint, fennel, spearmint, menthol, Manuka tree oil, sea salt and propolis) from commercial toothpaste manufactured by Grin Natural Products Ltd. were tested for antimicrobial properties against six aerobic oral bacteria, *Streptococcus (S.) sanguinis*, *Rothia (R.) dentocariosa*, *Streptococcus (S.) salivarius*, *Streptococcus (S.) oralis*, *Staphylococcus (Staph.) epidermidis*. A microtiter plate reader was used to conduct the experiment. The results showed

that fennel and manuka tree oil had the strongest antibacterial effect, which inhibited the growth of all the six bacteria for 48 hours. Spearmint did not show an inhibitory effect on the growth of *Staph. epidermidis*, but it inhibited the growth of *S. mutans*, *R. dentocariosa*, *S. salivarius* and *S. oralis* for 48 hours. When mixed with peppermint or menthol, only *Staph. epidermidis* showed growth in 48 hours during incubation, other bacteria did not grow. Propolis demonstrated strong antibacterial effect on growth of *S. mutans*, *R. dentocariosa*, *S. salivarius* and *S. oralis*, while its inhibitory effect lasted for less than 20 hours on the growth of *S. sanguinis* and *S. epidermidis*. Sea salt showed the weakest antibacterial effect, which only inhibited the growth of *S. salivarius* within 48 hours, while no inhibitory effects were observed on the other aerobic oral bacteria studied.

### **S19: Shuo Yang, Massey University**

*Microstructural changes during cold-pressed oil extraction of 'Hass' avocado (Persea americana 'Hass')*

Name(s) of author(s): Shuo Yang<sup>a</sup>, Marie Wong<sup>a</sup>, Allan Woolf<sup>b</sup>, Ian Hallett<sup>b</sup>

Affiliation(s): <sup>a</sup>Massey University, Auckland

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Cold-pressed avocado oil has become more and more popular in the commercial culinary oil field. The main aim of this study was to identify strategies to increase oil yields for the industry by understanding microstructural changes in the flesh of early-season 'Hass' avocado during various stages of the oil extraction process. Light microscopy was used to view flesh structure at defined steps during the extraction process (destoning, grinding, malaxing and decanting). During extraction, avocado oil was released from the parenchyma cells present in the avocado flesh, while the idioblast cells remained intact during the whole extraction process. The parenchyma cells were observed to be ruptured during destoning and grinding steps. Malaxing for two hours assisted the oil aggregation into larger droplets hence making it easier to recover a greater proportion of the oil. For the early-season fruit it was observed that oil was lost in the pomace when parenchyma cells were not ruptured during the process. Some free oil droplets were also observed in the pomace and wastewater (which is a loss to the producer). These findings will assist with future research investigating methods to enhance oil extraction from early-season 'Hass' avocado fruit.

### **S20: Siripong Kanokruangrong, University of Otago**

*Quantification of pyrazine compounds in cooked wet and dry aged meat*

Authors: Siripong Kanokruangrong\*, Aladin Bekhit

University of Otago

Pyrazine derivative compounds constitute almost 80% of the volatile compounds in cooked meat produced during cooking by Maillard reactions: the strecker degradation. These compounds were well researched in the early 60s to 70s when scientists identified pyrazine compounds from food and learnt that each derivative has their unique flavour and odour. For example, a 2-5-dimethyl pyrazine was reported to have a potato flavour. Pyrazine derivative compounds are now used in food industry as aroma ingredients enhancing food quality. Aged meats are only sold in upmarket restaurants as the aging process is time consuming and results in lower yields but it develops tenderness, juiciness and flavour richness in the meat. There is a gap in research on comparing the pyrazine compounds between cooked

meat after wet and dry aging. The aim of this project is to quantify and compare the pyrazine compounds in wet and dry aged meat. The meat will be cooked in a sealed system, extracting the volatile compounds by solid phase micro extraction method and quantified using gas chromatography coupled with mass spectrometry. The identity and concentration of each pyrazine present will be obtained from the chromatogram. It is hypothesised that cooked dry aged meat would have a higher number of derivatives and concentrations of pyrazines than the cooked wet aged. This is because strecker degradation is promoted when water activity is low and pH is high which is what occurs during the dry aging process.

### **S21: Siti Norbaizura Md Zain, Massey University**

*The isolation and characterisation of Paenibacillus spp in the dairy industry*

Siti Norbaizura Md Zain<sup>1,2</sup>, Mandy Kee<sup>1</sup> and Steve Flint<sup>1</sup>

Affiliation(s): <sup>1</sup>Massey University, Palmerston North Universiti <sup>2</sup>Teknologi MARA, Malaysia

Psychrotolerant spore-forming bacteria like Bacillus and Paenibacillus represent a major challenge to the dairy industry in extending the shelf life of pasteurised products. Spores are able to survive conventional pasteurisation, germinate and grow to numbers capable of causing sensory defects to refrigerated products. Paenibacillus is a Gram-positive, facultatively anaerobic, spore-forming bacteria often isolated from environmental sources such as soil and plant materials. Paenibacillus are occasionally isolated from dairy products but little is known about its importance in the dairy industry. In the present study, Paenibacillus isolated from milk and whey powders survived pasteurisation, grew at refrigeration temperatures, fermented lactose, produce lipase and protease and formed biofilms. They represent a threat to the quality of reconstituted milk that needs further investigation.

### **S22: Urte Bierlin, University of Otago**

*Antibacterial powers of five New Zealand hop varieties*

Urte Bierlin, Prof. Phil Bremer\*, Dr. Graham Eyres

University of Otago, Dunedin

Hops have been an important ingredient in beer for over 500 years. Over this time, they have become appreciated for their aroma, flavour and preservative properties. It is well known that “extra” hops were added to preserve India Pale Ales during the long sea voyage from England to India. It is therefore, somewhat surprising that relatively few studies have quantified the preservative ability of hops in beer. The compounds responsible for this activity and the mechanism of action are not well understood or researched. Therefore, studies in this topic are timely, as interest from craft brewers and beer consumers is driving the development of new and novel hop varieties, especially those with distinctive aroma profiles. Additionally, many craft brewers wish to export their beers which will put additional expectations on the stability and shelf-life of their products. The current study aims to assess the impact of hop concentration (in terms of International Bittering Units or IBUs), in conjunction with pH (4, 4.2 and 4.4) and ethanol concentration (2, 3 and 4%) against a range of beer spoilage micro-organisms, such as strains of Lactobacillus or Pediococcus. The Minimal Inhibitory Concentrations (MIC) of hot water extracts of five New Zealand hop varieties is being assessed using 96 well micro-titre plates. Alpha-iso-acids are being analysed using UV-spectrophotometer (275nm) and HPLC

based methods. This study will establish if different hop varieties, at specific pH- and ethanol-concentrations need to be used at different IBU levels to guarantee the inhibition of beer spoiling micro-organisms.

**S23: Yang Liu, University of Otago**

*Understanding consumers' out-of-home food waste practices in restaurants and cafés; promoting the usage of using doggy bags*

Names of authors: Yang Liu & Miranda Miroso

Affiliation: University of Otago, New Zealand

According to the Food and Agricultural Organization, one-third of food produced globally for human consumption is spoiled or wasted. Restaurants and cafés are major places where food is being wasted. Encouraging consumers to take uneaten food home in a “doggy” bag is an effective way of reducing waste.

This project aims to identify barriers and benefits of consumers' current doggy bag behaviours, and provide required information for an effective nationwide community-based social marketing campaign encouraging consumers to take their uneaten restaurant and café food home.

Methods include analysing existing survey data on consumers' current practices towards doggy bags from a nationally representative New Zealand sample.

Observations and focus groups were conducted to investigate consumers' behaviours and attitudes towards using doggy bags and to understand how to remove barriers.

Results showed identified barriers were both internal, such as lack of knowledge about how long it is possible to safely store the leftovers for at home, and external, such as the inconvenient design of currently available doggy bags. Multiple barriers to widespread doggy bag participation were common and varied for different individuals.

In conclusion, social marketing strategies and behaviour change tools can be developed to remove the barriers and enhance the benefits of using doggy bags, such as gaining a commitment from individuals, or developing community norms around using doggy bags. Moving forward with this project, a range of potential initiatives will be developed and then pilot tested before final recommendations for more widespread dissemination are made.

**S24: Ying Yi, University of Otago**

*Cross-cultural business-to-business communication: advice for New Zealand food exporters targeting Asia*

Name(s) of author(s): Ying Yi; Fiona Nyhof and Dr Miranda Miroso

Affiliation(s): University of Otago

Asia is an important market for the New Zealand food industry. Successful communication between companies is vital for ensuring market success. However, there are many cross-cultural issues, such as language barriers, difference in communication styles and work customs that need to be considered. The aim of this project is to provide advice to New Zealand exporters on how they can successfully target Asian companies, emphasising customer value propositions as the most important factor in cross-cultural business-to-business communications. The recommendations will be based on practical case studies that include direct communication with high end hotel group executive/executive sous chefs in Shanghai to investigate their customer-supplier relationships for the procurement of

imported foods such as beef; assistance with development of a presentation for a New Zealand export company who aims to deliver the contents to selected Asian food company executives, on a one to one basis at a trade show in Japan; and follow-up personal interviews with the tradeshow presenters in order to gauge the effectiveness of the communication. Initial results from the chefs indicated trust, price stability, delivery commitment, free samples, value for money, and sufficient expiry dates on products are key requirements for imported food suppliers who aim at food service industry. Practical recommendations on how to establish long lasting business relationships with executive chefs and new product development managers in key Asian markets such as Shanghai and Japan, based on the case studies will be reported as an outcome of this study.

**S25: Zahra Zolfaghari, University of Otago**

*Differentiation of New Zealand kanuka and manuka honey using rheometric parameters*

Z. Zolfaghari, J. Birch and G. Eyres

University of Otago, Dunedin

In this study we show the potential of viscosity and rheometric analysis in differentiation of manuka and kanuka honey in characterizing the floral origin of New Zealand unifloral honey samples. The following rheological properties were described: dependence of viscosity on a sample temperature, dependence of shear stress on shear rate. Based on the measured values, the Arrhenius mathematical model was applied and subsequently used for determination of activation energy. Tests were carried out under the temperatures ranging 0–40°C. The measured values revealed Newtonian behaviour of the tested honey samples in the whole temperature range.

**S26: Zhihao Hu, University of Otago.**

*Effect of polyethylene glycol (PEG400) and chitosan on the physical and mechanical properties of zein-containing film*

Name(s) of author(s): Zhihao, H.<sup>1,2</sup>, Ali, A.<sup>2</sup>, Oey, I.<sup>1,3\*</sup>

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

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<sup>3</sup>Riddet Institute, Massey University, Palmerston North

A growing need for biofuel leads a high demand for maize (corn) as raw material to produce bioethanol. As a consequence, this processing results in high amount of by-product such as zein. Corn zein is prolamine. This protein attracts an increasing interest in the research of edible film forming due to its unique plastic properties. Zein film usually has high brittleness without any additives. It has been reported that the use of plasticiser such as PEG400 and chitosan can impact the physical and mechanical properties of the film. The blend between zein and chitosan with appropriate plasticiser can form a better film with stronger water resistance and flexibility. The purpose of this research was to study the effect of polyethylene glycol (PEG400) as plasticiser and chitosan on the physical and mechanical properties of zein-containing film.

In this research, different concentration of PEG400 (0.1-0.5%) in zein and chitosan mixtures containing 1% acetic acid and 70% ethanol solution was used to alter the properties of film. The ratios of zein and chitosan between 50:50 and 90:10 were used in this study. The mechanical and physical properties of process films were

determined and presented. The results showed that increasing PEG400 concentration reduced the brittleness of zein film. The physical and mechanical properties of the films were also influenced by the ratio of zein and chitosan. This study shows that the appropriate ratio between zein, chitosan and PEG400 is required to create flexible film.

## General Poster Abstracts

**NB All abstracts have been Peer Reviewed.**

### **P1: Brent Gilpin**

*Approaches to identifying the animal sources present in foods*

Name(s) of author(s): Brent Gilpin, Beth Robson, Jenny Draper, Paula Scholes  
Institute of Environmental Science & Research Limited.

Confirming the animal sources present in a product is important for confirmation of labelling claims, investigations of suspected fraudulent activity, and assurance of the absence of certain meats (eg pork in halal products, allergens). We have evaluated a number of approaches including:

1. A multiplex PCR based assay for the cytochrome B gene which includes a non-specific target to ensure amplifiable DNA is present, and then specific assays for horse, sheep, cattle, poultry, pig and goat.
2. Where additional species are suspected, sequencing of the cytochrome B gene allows for comparisons with DNA databases.
3. Finally we have used massively parallel sequencing to amplify and sequence thousands of copies of ribosomal DNA from a sample. This potentially allows some quantitation of sources, and the detection of a wide range of animal types including those present in low proportions.

We have used these methods on a range of foods including bone meal, sausages, canned meat, ready meals, minced meat patties, meat pies, and in a prosecution situation to identify that blood on knives was from illegal slaughter of goats. We have also used them to determine the sources of milk present in cheeses.

### **P2: Cheng QIAN**

*Occurrence of *Staphylococcus aureus* in poultry processing environment*

Name(s) of author(s): Cheng QIAN, Evelyn Sattlegger, Anthony N Mutukumira  
Massey University, Auckland

Contamination of food by *Staphylococcus aureus* (*S. aureus*) is mainly attributed to poor food handling or cross-contamination during food processing. This has been a major concern in many countries because some strains can produce one or more staphylococcal enterotoxins (SEs). Outbreaks of staphylococcal foodborne illnesses have also been reported in New Zealand (NZ). The NZ outbreaks were associated with contaminated yogurt, hot ham sandwiches, chicken salad, and hot turkey sandwiches. The aim of the study was to identify potential contamination sources of poultry products by *S. aureus* during processing environment. Fifty *S. aureus* colonies were isolated from three fresh final ingredients from secondary processing plant (Fresh Mechanically Separated Meat (MSM); Fresh Skin and Fresh Skin-on Breast Fillet (SO BF); Rubber Fingers in pluckers of the primary processing plant, and swabs were collected from live chickens at a farm. Enterotoxigenic genes *seg*, *sei*, *sem*, *sen*, *seo* were identified in 49 of the 50 isolates. To trace the contamination sources, the sequence types (STs) of the 50 *S. aureus* isolates were identified using the Multilocus Sequence Typing (MLST) method. Four different sequence types were identified among the 60 isolates: ST5, ST2594, ST101 and ST83. The sources of *S. aureus* contamination in the final poultry products were linked to Fresh MSM, Fresh Skin, Fresh SO BF (secondary processing) and Rubber Fingers in the pluckers

(primary processing). Our study suggested that the rubber fingers were most likely the sources of contamination of the analysed samples by *S. aureus*.

### **P3: Fan Zhu**

*Staghorn Sumac-Fortified bread: anthocyanin content, mould-free shelf-life, and sensory aspects*

Name(s) of author(s): Fan Zhu<sup>1,\*</sup> and Sunan Wang<sup>2</sup>

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Staghorn sumac (*Rhus hirta*) is native to North America and has been adapted to New Zealand. Sumac bobs contain various bioactive compounds such as anthocyanins. Various health benefits such as anti-oxidative, anti-cancer and anti-microbial, and anti-obesity effects have been related to staghorn sumac. The feasibility of using commercially available sumac extracts up to 2% of wheat flour in bread making was reported for the first time. Adding sumac extracts up to 2% had minimal influences on the color and texture of bread. Increasing sumac concentration from 2 to 10% expanded the mould-free shelf-life of bread from 1 to 6 days, while the anthocyanin retention levels in bread varied from 12 to 37%. Sensory evaluation showed that overall acceptability of bread containing sumac extracts up to 2% were comparable with the control. Organoleptic, textural, and shelf life properties of bread with 2% sumac substitution were the similar as those of control. Sumac-derived functional ingredients hold great potential for promoting the safety, quality, and health benefits of bakery food products.

### **P4: Jennifer Young**

*Does believability matter? Exploring women's responses to the claims of weight management foods*

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This research explores consumer responses to the concept of weight management functional foods. The foods claim to offer easier control over eating, by fortification with satiety-enhancing ingredients, to give a 'fuller for longer' benefit. Weight loss is an increasingly important, yet elusive goal for many consumers, and hunger can lead to failed weight loss attempts. However, research has not yet explored whether consumers will believe the claims, given their personal weight loss activities and lived experiences. Therefore, this interpretive research aims to understand the way in which women make sense of the claims and to qualitatively understand the personal biases and socio-cultural influences that impact their judgements. In-depth interviews were collected from 14 New Zealand women (aged 35-65 years), seeking to lose weight. The findings reveal uncertain believability responses, counter arguments and scepticism. Participants were unsure how the foods would help with their deeper concerns about 'emotional' hunger. Yet there was simultaneous interest in trying the foods, due to the emotional bias of hope on cognitions. Motivated reasoning for not wanting to miss out on advancement towards weight loss goals was revealed. Diversity in the judgement occurred due to the influences of identity, perceived self-control challenges, and underlying weight/body image concerns. It is concluded that believability judgement occurs as a personally meaningful assessment, subject to confirmation.

Implications for marketers looking to launch weight management functional foods are provided, including proposals to move beyond existing weight loss appeals to better resonate with women seeking weight loss.

**P5: Tajwinder Kaur, Amandeep Kaur, Ravneet K Grewal**

*Kinetic modulation of bromelain (*Ananas comosus*) as a function of activators and inhibitors*

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Bromelain is extracted and purified from pineapple (*Ananas comosus*) with ammonium salt precipitation, dialysis and DEAE ion exchange chromatography; and kinetics of cysteine and divalent ion modulation viz.  $\text{Ca}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Hg}^{2+}$  of fruit bromelain (EC 3.4.22.33) have been investigated in the present study. Kinetic studies reveal that at pH 4.5, cysteine induces V-type activation of bromelain catalyzed gelatin hydrolysis. At pH 3.5,  $\text{Ca}^{2+}$  inhibits the enzyme noncompetitively, whereas both K- and V-type activations of bromelain are observed in the presence of 0.5 mM  $\text{Ca}^{2+}$  at pH 4.5 and 7.5. Bromelain is inhibited competitively at 0.6 mM  $\text{Cu}^{2+}$  ions at pH 3.5, which is changed to an uncompetitive inhibition at pH 4.5 and 7.5. An uncompetitive inhibition of bromelain catalyzed gelatin hydrolysis is observed in the presence of 0.6 mM  $\text{Hg}^{2+}$  at pH 3.5 and 4.5. These findings suggest that modulation of fruit bromelain by divalent ions is pH dependent.