

# FOOD SAFETY MATTERS CONSUMED

July 2017 | Issue 01



New Zealand  
**FOOD SAFETY SCIENCE  
& RESEARCH CENTRE**

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It is now one year since the launch of the New Zealand Food Safety Science & Research Centre. Welcome to our first e-newsletter, celebrating the work of NZFSSRC researchers, and profiling some of the current and planned work of the Centre.

To cap an exciting and successful first year, the NZFSSRC held its inaugural annual meeting in Nelson on 03 July 2017. This meeting provided an opportunity to showcase not only the best of New Zealand's research relating to food safety, but also to highlight global efforts to address burning food safety-related issues and our contribution to that work. It is vital to ensure the work of the NZFSSRC aligns with industry needs and Government expectations and we were delighted to host representatives and speakers from both those sectors at the meeting as we continue to implement a collaborative, integrated approach to addressing food safety issues.

The newly appointed Food Safety Minister, the Honorable David Bennett, visited NZFSSRC at its Massey University site in May of this year. The visit provided an ideal opportunity to learn first-hand about the cutting-edge work of NZFSSRC contributing research institutions. The Minister

met senior University staff and NZFSSRC Chair Kevin Marshall. The Minister was well-attuned to the food safety imperatives for New Zealand exporters and our local and overseas consumers. The Centre provides the firm footing of science to support government and industry.

On behalf of the NZFSSRC I would like to congratulate Dr Lesley Rhodes, a member of our network, on her recent appointment as a Companion of the New Zealand Order of Merit (CNZM) in recognition of her pioneering work in seafood safety.

I would like to thank the Centre's Board Members and the Science Leadership Team who represent our research partners, for their invaluable support, advice and goodwill. I would also like to give special thanks to Wendy Newport-Smith and Michal Dunn who have made an outstanding contribution to the Centre over the past year.

**Nigel French**  
Director



**Professor Arie Havelaar**

We are privileged to host five leading international food safety scientists in Nelson, including Professor Arie Havelaar, the Chair of our International Science Advisory Panel, Professor Leon Gorris, responsible for global food safety at Unilever and Dr Anne Astin who holds a number of key government and industry appointments and had an important role in the New Zealand Government enquiry that led to the setting up of the NZFSSRC.

Videos of the presentations at the NZFSSRC meeting will soon be available at <http://www.nzfssrc.org.nz>

# (SAFE) FOOD RECOVERY

We have become painfully aware of the astonishing amount of food waste. Between 30 and 50%! Think of those browning other-half avocados, the last few slices of mouldy bread, the left over spinach quietly turning to slime in the bottom of the chiller, the mad ill-considered dashes around the supermarket after work. And then there is the past use-by-date food necessarily jettisoned by restaurants and supermarkets. None of these businesses wants to waste food. Why would they throw money in the bin? It's just hard to perfectly anticipate demand.

Think of all the wasted water, fertiliser, packaging and fuel it takes to produce that binned food. Not to mention the human effort involved. Research suggests that household food waste is the largest component, averaging an estimated loss of \$550 per household per year in New Zealand. The waste ends up rotting in landfills. University of Otago consumer food scientist, Dr Miranda Miroso, her colleagues, students and legions of energetic, entrepreneurial New Zealanders, to the rescue.

Miranda describes herself as “an interdisciplinary with a background in marketing and consumer behaviour. My research aims to understand why people eat what they do, why they don't eat what they don't, and how we might best impact upon these choices to encourage people to choose quality, healthy and environmentally sustainable foods.” She is currently involved in the WasteMINZ (the representative body of the waste and resource recovery sector in New Zealand) National Consumer Food Waste Reduction project and the Love Food Hate Waste campaign to reduce household food waste.

Miranda established the University of Otago Food Waste Innovation Research Group, which brings together social and pure scientists to discuss the challenges surrounding food waste and how to solve them. There are many inspiring food recovery initiatives cropping up around New Zealand. For example, a group of volunteers in Wellington collects left-over food from restaurants and distributes it to anyone who wants it – no questions asked - from a converted shipping container in the grounds of St Peter's Church in Willis St. <https://www.thefreestore.org.nz/> Such initiatives are directly helping to mitigate climate change, as well as poverty.

“My research aims to understand why people eat what they do, why they don't eat what they don't and how we might best impact upon these choices.” - Dr Miranda Miroso

Miranda says a change to legislation (The Food Act 2014) means that restaurants can now readily donate left-over food without worry over liability, provided it is in good condition when it leaves their premises. That has removed a significant impediment. Food safety is the prime consideration for any food recovery group. It is incumbent on these groups to ensure safe handling practices. In Miranda's experience, they have sophisticated protocols and intensive staff induction training, and she is not aware of any problems.

Apart from food recovery issues, Miranda's group are investigating ways of using waste products like fruit peelings and perfectly healthy, but not very pretty, fruit and vegetables rejected by consumers. For example, they can be made into juices.

They have also organised public cooking demonstrations by “Supergrans”, who are old to enough to remember a time when food was not so cheap or readily available. They show students and recipients of rescued food how to make “something out of nothing”.

Miranda is the Otago lead for the NZ China Food Protection Network, allied to NZFSSRC. She is spending a lot of time in China and Taiwan on an

APEC funded project to assess food loss and waste throughout the supply chain, and to respond with policy recommendations.

Food safety is the most important consideration for Chinese consumers. Understandably, there is heightened sensibility after some serious food contamination incidents. Miranda wants to help New Zealand exporters understand what cues Chinese consumers respond favourably to, e.g. guarantees of traceability, values associated with the country of origin, imagery, wording, and attitudes to food processing techniques such as irradiation.

The Chinese students in the Otago Research Group help give local researchers an insight into Chinese attitudes, customs and practices.

Miranda was a member of a recent science mission to China, where she and her colleagues made useful connections with social scientists at Xian Jiaotong Liverpool University, who have common interests in consumer perceptions and behaviour.

Returning to the more immediate, local problem of that other half of the avocado, Miranda advises keeping the stone in and wrapping it straight away with cling film. She has the research to back it up!



# MISSION TO CHINA

In April, Centre Director Nigel French and Manager Wendy Newport-Smith went to Beijing and Shanghai with other NZ scientists to learn about research of mutual interest and investigate opportunities for collaboration. It was also a chance to get a better understanding of their food production and marketing systems, and Chinese consumer attitudes and behaviour.



China is now our biggest trading partner, and exporters are working hard to retain the benefits of the 2008 landmark NZ-China Free Trade Agreement.

Dairy products are becoming very popular in China, especially yoghurt. New Zealand is their biggest supplier of milk powder and third biggest supplier of infant milk formula. An interesting social demographic is the early retirement age of Chinese people; grandparents typically look after young children to allow their parents freedom to work.

A difficulty for NZ exporters is not being able to control the whole food chain, with associated risks for their reputation as New Zealand experienced when unscrupulous sellers contaminated infant formula with melamine. Two of New Zealand's 11 dairy companies - Yashili NZ Dairy Co. Ltd and Oceania Dairy Ltd have Chinese partners, respectively Mengniu/Yashili and Yili, China's largest dairy producer. Fonterra has 8 farms in China, with about 60,000 cows, and has developed animal health standards with NZ and US vets that have been adopted in China.

The scale of everything in China is rather overwhelming and the system is hard for New Zealanders to navigate. The efficient schedule of highly targeted meetings and visits would not have been possible without the facilitation of NZ Embassy staff in Beijing, and Fonterra's Director of Regulatory Affairs and Quality, Mr Tao Wang. Nigel and Wendy

were able to meet key scientists at Shanghai Jiao Tong and China Agricultural University - two of the top ten Chinese universities. Shanghai Jiao Tong has a Food Safety Centre, jointly funded by the US Department of Agriculture and China. Dr Miranda Miroso (University of Otago) and Professor Phil Bremer (also UoO) organised a workshop on the first day of the visit. Nigel outlined the work of the NZ-China Food Protection Network, which is allied with NZFSSRC. It makes sense for Chinese and New Zealand scientists to cooperate on common food safety issues such as salmonella and listeria.

Nigel says COFCO's Nutrition and Health Research Centre in Beijing is the most impressive facility he has ever seen. COFCO is an enormous company of long standing - it stands for China National Cereals, Oils and Foodstuffs. It is one of 5 top agribusinesses in the world, and is also involved in real estate and finance, as well as foodstuffs. They import dairy products and manuka honey from New Zealand. Their Nutrition and Health Research Institute has 7 high-tech R&D areas, including food quality and safety. Consumer preference is quite a science there - they have a state-of-the-art laboratory for measuring consumer sensory perceptions, and a test supermarket with cameras and facial recognition software that tracks people's eye movements and assesses subtle emotional responses. Food is big business, and highly competitive! They were very interested to hear about University of Otago work on consumer perceptions.

An important outcome of that visit was the arrangement for a Chinese scientist employed by COFCO, Lishui Chen, to spend a year at the Massey-hosted centre from mid 2017 this year,

mapping the whole food safety system in China. This will be extremely helpful to Centre scientists as well as New Zealand food and beverage producers and regulators.

There is opportunity for further collaboration on emerging technologies to trace and validate food and beverages, which is so important for consumer confidence and a huge compliance incentive for producers and marketers. It can prevent products being fraudulently marketed as higher value forms, e.g. soy or ewes' milk as cows' milk, or ordinary honey being sold as manuka honey. There is already a joint research project underway with University of Otago and CAAS.

The New Zealanders were fascinated by the range of food on offer in China. They were taken to a "wet market" in Shanghai, a traditional Chinese market where the food is local and freshness is imperative. The nature of food is undisguised by processing and packaging. At the other end of the scale was Sam's Club, an American/Chinese "big box" retail store with a bewildering range of imported products.

The itinerary ended with a meeting with the Chinese Scholarship Council, which administers no fewer than 9000 PhD scholarships, to discuss possibilities for PhD students to come to New Zealand. There is also interest in short-term experiences for Chinese scientists of 3-6 months, which could be arranged through the NZ-China Food Protection Network.

The science mission happened to be in China on one of our most important anniversaries: 25 April. Attending the ANZAC Dawn Ceremony at the NZ Embassy in Beijing, together with fellow New Zealanders and representatives of other nationalities, will not be forgotten, says Nigel. Nor will the friendships and associations they formed with many Chinese people. Relationships, relationships, relationships.

Springer Browne, PhD student, Massey University

## INVESTIGATING *E. COLI* O157 AND O26

Springer (Andrew) Browne has been investigating the incidence and spread of *E. coli* O157 and O26 (STEC) for his PhD thesis. These bacteria are commonly referred to as STEC, short for shiga toxin-producing *E. coli*. His research suggests that these variants probably entered the country about 50-60 years ago in imported cattle. It was a while before DNA analysis made it possible to differentiate it from the many other strains of *E. coli* bacteria naturally present in human and animal guts, though the symptoms of infection in humans set these variants apart.

Dr Adrian Cookson of AgResearch, one of Springer's PhD co-supervisors, says that Springer's work is part of a general drive to understand STEC transmission in the dairy environment and identify farm practices that can be modified to reduce the levels of STEC on dairy farms.

To collect data for his PhD study, Springer comprehensively surveyed a random sample of 100 farms in our main dairying regions - Northland, Waikato, Taranaki, Manawatu, Canterbury and Southland. He tested various sites on these farms - shed floors, pasture, colostrum, udders, hinds, and calves. Springer found that calves carry relatively high levels of STEC - 20% of calves on 75% of the farms were carriers. *E. coli*, including STEC, colonise the calf gut very quickly after they are born, and are readily transferred in the close quarters of farm sheds and trucks en route to the abattoir. In fact, the number of STEC on the calves he tracked increased four-fold between leaving the farm and abattoir processing. However, virtually all STEC are removed from carcasses when they are washed in hot water during processing.

Like most *E. coli*, STEC have no ill effects on cattle. Most *E. coli* colonising humans are harmless too, but STEC can cause serious infection in young children with immature immune systems. The ultimate focus of Springer's research is prevention: to limit the incidence and spread of STEC. Most infections are acquired by people in close contact with cattle, with

a spike in cases at calving time. Over 400 cases of infection were reported last year. Environment Science and Research (ESR Ltd) now routinely tests all human faecal samples - taken for whatever reason - for STEC.

Overseas, *E. coli* O157 is ruefully referred to as the 'burger bug' or 'hamburger disease', because of the high number of infections caused by minced meat that is not cooked properly. When meat is minced, the microorganisms naturally present on the surface become mixed right through the meat. Food-borne infections are relatively rare in New Zealand because of our generally high standards of hygienic meat production, food handling and cooking practices. Although the chance of food-borne infection with STEC is low, the consequences are severe. This underlines the importance of continuing to develop and implement effective control measures in the meat production chain, as well as ensuring adequate cooking in homes, restaurants and fast-food outlets.

Identifying and tracking the bacterium has been made possible by the phenomenal advances in genomics. The cost and speed of DNA sequencing have dropped to a level where it is feasible to sequence, analyse and compare the genomes (all the DNA of an individual) of a significant sample of a population. It enables scientists to definitively track the source and relationships of species, including those prevalent overseas.



### ABOUT SPRINGER BROWNE

Springer grew up in California and went to Vet School in Dublin, his family's ancestral place of origin. He has already used his veterinary knowledge in a very practical way to help communities and animals in distress. Most recently, he went to Edgumbe to support people with pets and farm animals injured or killed by the floods.

He travelled to the deep hinterland of Nepal after the earthquake on 25 April 2015 killed 9000 people. Many cattle, on which these subsistence farmers utterly depend, were killed or suffered broken bones and other injuries - and the people were in need of moral as well as practical support after such a trauma. Springer and his co-vets gave tutorials to locals on how to properly dispose of dead animals, as well as caring for the injured ones. They spread the messages further via radio. Springer also went to the Philippines after Super Typhoon Haiyan (November 2013), but in the wake of that disaster, animals were either dead or deserted, so part of the job was reuniting animals with owners, as well as outreach to farmers whose land had been devastated.

Springer spent two summers in Kenya studying a form of coronavirus that emerged in 2012, MERS-CoV, or Middle East Respiratory Syndrome. It has been killing people in the Middle East, where it is transmitted to humans by camels

Life in Palmerston North is quiet and predictable by contrast, but the work is exciting, the coffee is excellent, and the chickens he keeps are great companions, says Springer (Chickens were an early inspiration that led him toward a career in veterinary research). He can focus on his goal to make a direct, practical difference to animals, people, and the economy.





Dr Andrew Kralicek, Plant & Food Research Ltd, Auckland

## SUCCESS IS IN THE AIR

### ABOUT ANDREW KRALICEK

Andrew was born in Waihi. He went to McLean's College in Auckland, where he became interested in how life works at the molecular level. "Proteins are the workhorses," he says. Andrew studied proteins involved in DNA replication for his PhD at Auckland University and first postdoc at the Australian National University, followed by cell division during his second postdoc at the Centre of Biological Investigation in Madrid, Spain. He is now leader of the Molecular Sensing Team at Plant and Food Research.



Andrew Kralicek's dream is in view. A portable, affordable, accurate device to detect tiny concentrations of volatile organic compounds. Such a biosensor could be used to indicate:

- the ripeness and firmness of fruit
- precursor compounds for the critical flavours in wine
- the presence of pathogens
- algae in drinking water
- biosecurity threats such as the dreaded Queensland fruit fly
- a variety of human diseases - there are 2000 compounds on our breath and characteristic healthy vs disease profiles
- the provenance of a food

Andrew is getting ready to build a prototype of this sensing device and there is great interest in it from consumers, and therefore marketers, who are becoming more and more concerned about the quality, safety and provenance of food. He was the first to receive a \$20,000 development grant from Callaghan Innovation's KiwiNet Emerging Innovator Fund.

The idea for the sensor is based on biochemistry borrowed from nature - the phenomenal ability of insects to smell, which has evolved over 2 million years. Unlike humans, insects have receptors on their antennae, so they can smell on the fly, as it were. We all know how fast blowflies arrive at the pot of mince on the stove. Their sense of smell is exquisitely sensitive - they can pick up one part in a million billion (one followed by 15 zeros). This is essential for their survival in a competitive world to find food and mates and warn them of danger. Bees can be trained to smell and locate ant pheromones miles away, given sugared water rewards.

Our own sense of smell has diminished by 2/3 - only a third of our olfactory genes are active. We cannot smell food contaminants, such as salmonella. We have only 350 working receptors compared to a dog, which has

about 1000. Smell, like sight, differs among individuals and related groups, accounting for different tastes in food, drink and perfume. Understanding these preferences is very important for food exporters.

The adult fly has only 24 receptors, but in different combinations they can detect and differentiate hundreds of volatile organic compounds. Insects can recognise a whole suite of compounds - alcohols, esters, ketones, aromatics and aldehydes. There is a size limit on the molecules they can detect, simply because heavy molecules cannot fly. The compounds bind to the protein receptors, which changes the electronic signal to the brain. How they register that signal in the brain as a "smell" we are just beginning to understand.

NZFSRC is excited about the possibilities for such a powerful way of protecting and enhancing New Zealand's reputation for safe, high quality produce. Currently, it takes days to get results by the time you send samples to the lab and analyse them using traditional methods such as growing cultures in petri dishes. What we need, especially where there is a biosecurity or health threat, is the immediate, portable on-site monitor that Andrew's work promises.



## IN SEARCH OF MAHINGA KAI

Being able to harvest food from the wild used to be a characteristic of the New Zealand way of life for Maori and Pakeha. Gathering mushrooms, hunting wild pig and deer, fishing, eeling, whitebaiting, and harvesting watercress are much less common today, not just because some of them are now scarce. But people are wanting to return to these traditional and very enjoyable ways of putting food on the table. Our elders still have cherished memories of the best fishing spots, eels the size of sharks, and buckets of whitebait. (Some of the fish have put on a lot of weight over time.)

These days we're a bit unsure about where the mahinga kai (food gathering sites) are, and what wild foods are safe to eat. Do you know what watercress looks like? Can you tell an edible mushroom from a poisonous one? How do you know those mussels and toheroa haven't absorbed pathogens from the water and are going to make you very sick? What times of the year are certain foods available and good to eat?

As part of an ongoing river catchment restoration project in Uawa/Tolaga Bay on the East Coast north of Gisborne, the Centre has joined forces with the local iwi (Te Aitanga a Hauiti), Tolaga Bay Area School, Plant and Food Research Ltd, and catchment restoration consultant, Ground truth Ltd,

to survey mahinga kai and potential threats to the safe consumption and sustainable harvesting of various wild foods. This has been made possible under the Vision Maturanga Fund run by the Ministry for Business, Innovation and Employment.

As well as taking part in a comprehensive "kai-blitz" to see what food is available in their rohe, students of Kahukuranui will interview elders to capture their stories and matauranga, and maybe get them to divulge the whereabouts of those fishing spots. How did they preserve and cook the food they collected?

This information will be incorporated into a community resource, and presented at a hui, to tell people how to identify and best use available mahinga kai, how to evaluate whether foods are safe to eat, and provide a checklist for food safety. This, of course, is where the science expertise comes in. Scientists will explain how to manage food safety risks, and the science behind food preparation and safety practices. The resource will draw on existing information provided by the Ministry for Primary Industries, and "feed into" the Healthy Families programme run locally by Te Whare Hauora o Te Aitanga a Hauiti. This is one progressive community and a school that always strives to give its students practical, interesting and relevant knowledge.



### A 'VIRTUAL' CENTRE

The NZFSSRC pools the existing resources of partner organisations from across New Zealand. Current NZFSSRC partners are:

#### FUNDERS:



**MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT**  
HĪKINA WHAKATUTUKI

Ministry for Primary Industries  
Manatū Ahu Matua



#### COLLABORATING PARTNERS:



New Zealand  
**FOOD SAFETY SCIENCE  
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