

CONSUMED

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

IN THIS ISSUE

A LONG WAY FROM BEIJING

Dr Lishui Chen

INDUSTRY PROFILE: KAREN MORRIS, ALLIANCE GROUP

NEUROTOXIN IN SHELLFISH

Laura Biessy

INVESTIGATING ANTIMICROBIAL RESISTANCE

Rose Collis

FOOD SAFETY IN THE 21ST CENTURY

Professor Nigel French



Charles and Candy Eason

Cawthron CEO, Professor Charles Eason

RECOGNISED FOR SCIENCE LEADERSHIP

Professor Charles Eason received the Thomson Medal at this year's Research Honours Dinner in Auckland on 10 October. It was awarded by Royal Society Te Apārangi for his outstanding leadership in his research career and for his achievements as CEO of the unique Cawthron Institute (from 2012), which employs 200 scientists and is a member of NZFSSRC. Director Nigel French says that Charles has been a key supporter and closely involved with the establishment of the Centre.

Cawthron Marine Toxin Chemist and Safe New Zealand Seafood programme lead, Dr Tim Harwood, says Professor Eason is a strong advocate for food safety research, testing, and development. "He understands the importance of food safety to New Zealand's export-focused economy and his leadership has drawn on his experience linking scientific innovation with commercial realities. As a leading scientist himself, he understands the demands of consistently producing useful and impactful science."

The Cawthron Institute's dedication to food safety involves teams spanning a wide range of science disciplines. There's a significant diversity of skills involved in their work, from undertaking routine phytoplankton testing, researching toxins, to developing reference standards. (See the article in this issue on PhD student at Cawthron, Laura Biessy, who will be investigating a powerful neurotoxin found in some shellfish.)

From the Royal Society Te Apārangi award citation:

Under his leadership as Chief Executive, new funding has been secured and new buildings and laboratories built, including the world's largest mussel hatchery, funded by Sanford, which opened in the Cawthron Aquaculture and Research Park in 2015. These new facilities are allowing Cawthron to build on its expertise in aquaculture breeding, seafood safety, nutraceuticals, and coastal and freshwater ecology.

The medal selection committee said Professor Eason's ability to link scientific innovation with commercial experience has had a global impact in the areas of chemical toxicity, pest control, food safety, aquaculture, drug development, and environmental protection. As a leader at Cawthron, they noted his skill in developing and consolidating staff capabilities, infrastructure, and financial viability.

Professor Eason's science speciality is toxicology, particularly in relation to drugs and natural compounds. He has worked in controversial areas such as chemicals for predator and possum control and fluoridation of water.

Dr Lishui Chen

A LONG WAY FROM BEIJING

An immediate outcome of the Centre's visit to China in April was the arrangement for food scientist Dr Lishui Chen to spend a year at NZFSSRC in Palmerston North. Lishui arrived in July. His travel is funded by the NZ China Food Protection Network, and salary paid by his employer COFCO, China's largest food processor, manufacturer and marketer. He works for their Nutrition Health Research Institute in Beijing.

Lishui's rather daunting task is to update a comprehensive report on the food safety and security landscape in China and NZ. He will compare food regulations, particularly those relating to dairy and meat products. His roadmap of such a large and unfamiliar system, and his recommendations for NZ exporters, will be invaluable.

Lishui is helping Dr Adrian Cookson of AgResearch Ltd, a principal contributor to the Centre, organise a workshop on antimicrobial resistance, at China Agricultural University, in Beijing this November.

His research interests include functional foods and macrobiotics, in addition to food safety. His PhD from Harbin Institute of Technology was on probiotics, which are a multi-billion dollar market in China. Lishui will be talking to scientists in NZ from the Riddet Institute and other Institutes during his stay. COFCO has up to the minute facilities to test new functional foods and consumer response to them. Lishui's R&D work has included functional foods for older people, dietary supplements for pregnant women, and raw milk derivatives. Ultimately, mass market response to new foods is

measured from sales through the COFCO company's 7 shopping malls, called Joy City. Chinese diets have been changing very rapidly. Instant noodles, western foods and take-away chains have become the norm in the big cities. However, there is considerable regional variation.

In Lishui's home province of Hunan in central southern China, "hot and spicy" sums it up. Chillies of every description open the pores and help you cool down in the humid summers.

Lishui is enjoying the change to the cool, fresh climate and landscape of less populous Manawatu. He even gets the weekends off.

PROBIOTIC PROS

On 18 October, it was announced that a study funded by Fonterra and the Health Research Council, conducted by Auckland and Otago Universities, showed that a probiotic derived from fermented dairy product (*Lactobacillus rhamninusus HN001*), taken during pregnancy, can prevent postnatal depression.



Karen Morris, representing the Meat Industry Association at the Nelson NZFSSRC conference

INDUSTRY PROFILE: KAREN MORRIS, ALLIANCE GROUP

Karen Morris was born and bred in Dunedin. The interview is conducted as she drives home to Gore from the Alliance Plant in nearby Matura. Part of her job as Group Food Safety and Market Access Manager for Alliance Group involves doing the rounds of their 8 North and South Island Meat Processing Plants. Karen has worked in the meat processing industry for 22 years and has a wide range of roles. Prior to entering the meat industry, she began her career with a job in a research laboratory in Dunedin.



One size does not fit all when it comes to meeting the demands of countries importing our lamb and beef. Some want carcasses to have a final treatment with hot water or a surface antimicrobial agent, while others ban the use of chemicals and certain types of products (tonsils/ brains), and others set date ranges for shelf life and the period between slaughter and packing. Karen's job is to ensure Alliance Group complies with all these requirements.

New Zealand has the increasingly important advantage of producing animals which are grass-fed and live their lives under the wide open skies. This means there is little need to use prophylactic antibiotics, which are more likely to be routinely administered to animals living in close quarters under cover. There are strict withholding periods for slaughtering animals that have been treated with any kind of agricultural chemicals or medicines - some of the many rules and regulations Karen has to manage.

Most of our export meat is processed according to Muslim halal custom. New Zealand has strict regulations governing this procedure. The animals are first stunned to ensure they are completely unconscious before and during the slaughter process. All processing facilities have MPI veterinarians on site to monitor these operations. Live animal exports for slaughter are now banned.

Consumer perception of our meat and understanding what drives consumption patterns is all important. "Animal welfare is critical," says Karen. Consumers want animals that have lived their lives as close to nature and their individual natures intended. Other factors are nutrition and health, value for money compared to other proteins, the provenance and traceability of the meat, size of families (smaller families want smaller cuts), changing cooking styles,

Consumers want animals that have lived their lives as close to nature and their individual natures intended.

the growing demand for organic foods, water use and carbon footprint. Counter-intuitively, the shipping of produce from New Zealand to Europe accounts for only 5% of the carbon footprint. This makes our meat competitive from all viewpoints - animal welfare, carbon footprint, quality and price.

Tim Ritchie, CEO of the Meat Industry Association, reports that the largest importer of our meat is China. They buy around NZ\$1.5bn per year in total, made up of beef (\$500M), sheep-meat (\$650M), and other parts of the animals, such as hides and pelts, tallow and offal (\$300M).

A significant area of farm land has switched from sheep to dairy. Tim says that although the total number of sheep for processing has reduced, improved farming practices have meant that the volume of export meat has stayed virtually the same: larger animals, improved fecundity and lower mortality.

The supply and demand equation is fairly tricky these days now that a significant percentage of export meat is chilled rather than frozen. Climate, the weather, seasonal demand, the price of wool, and the flux in dairy herd size, all affect the mix and can only be forecast a short time ahead.

Karen is proud of the New Zealand farming and hygienic dressing systems that result in very low levels of STECs (shiga toxin producing *E.coli*

bacteria). Testing for STECs is required for bovine product exported to the U.S. Toxic strains of *E.coli* have caused large-scale outbreaks of food poisoning in the U.S., where the regulations do not require cooking set time and temperature parameters sufficient to kill the bacteria in burger meat. Burgers can be ordered and served rare, and typically come with warnings to the consumer that they have no come-back on the restaurant if they get sick. As far as we know, no-one in New Zealand has contracted *E.coli* infection from eating cooked or undercooked red meat. STEC notifications recently have been attributed to animal handling, or person to person contact.

There are no processing techniques that can eliminate all bacteria, short of using ionising radiation, says Karen, and this is not an approved method in New Zealand. Few bacteria are actually harmful. In fact cattle and humans depend on many of them to assist with digestion of their food and conduct other physiological processes. Thorough cooking reduces the risk of food poisoning.

Karen sees a lot of value in the NZ Food Safety Science & Research Centre to ensure we remain world-leading, and can anticipate any risks. Food safety is paramount, and now taken for granted by consumers in New Zealand, but not in other countries. The Centre gives companies such as Alliance access to a national skill and research base here and overseas, and the opportunity to implement new technologies early on.

"We can never be complacent, but at the same time, I feel very confident that we can stay at the forefront internationally with this kind of vigilance and support," says Karen.



Laura Biessy PhD student, Cawthron Institute

NEUROTOXIN IN SHELLFISH

Laura Biessy has been awarded one of two inaugural NZFSSRC PhD scholarships. The second scholarship goes to Rose Collis (see page 5). Both the PhD scholarships are being funded from Massey University's contribution to the Centre, as the host organisation.

Laura will investigate the source of a very powerful neurotoxin (Tetrodotoxin) that has recently been found in bivalve shellfish (scallops, mussels, pipi, oysters). She comes from Lyon, France, and has been working in the Environmental Technologies Group at the Cawthron Institute for 4 years, using molecular tools to identify and study the production of marine and freshwater toxins.

She is thrilled to be able to now make her own contribution to the marine world she loves, from a place she loves and is now very settled in - Nelson.

Laura is enrolled at Waikato University with Professor Ian Hawes (Antarctica researcher) and Dr Susie Wood (molecular biologist) as University supervisors. Her supervisor at Cawthron is Dr Tim Harwood, Marine Toxin Chemist and NZFSSRC Chemometrics platform leader. Dr Kirsty Smith, an expert in molecular ecology, and Dr Lesley Rhodes, recently awarded a CNZM for her contribution to food safety and harmful algal research, are co-leading the nationally significant Cawthron Institute Culture Collection of Microalgae (MBIE-funded) and are both on Laura's supervisory committee too.

Laura has already collected samples of pipis from sites within the Hokianga Harbour in Northland. She plans to take more samples from Nelson and Marlborough coastal sites. Laura will test the hypothesis that the toxin is produced by *Vibrio* bacteria using DNA metabarcoding to compare bacterial species present in the toxic and non-toxic shellfish, as well as in sediment and water samples. Tetrodotoxin (TTX) is the same toxin that makes

puffer fish so lethal – one has enough to kill 30 humans. It paralyses the nervous system by blocking the passage of sodium ions. In Auckland, 2009, several dogs died when they ate sea slugs containing very high levels of TTX. As far as we know, it has not yet been present at high enough levels in shellfish to result in human poisoning.

Key questions that Laura will address as part of her study are: how long does it take for shellfish to eliminate the toxin, and how much can they accumulate? To this end, Laura will conduct controlled lab experiments, giving shellfish different amounts of the toxin to measure the rate of elimination and/or bioaccumulation.

Laura's PhD investigation is aligned to research being performed within the Safe NZ Seafood research programme, funded by MBIE (\$2.3M per year for 7 years). The programme, led by Tim Harwood, identifies and mitigates pre- and post-harvest seafood safety risks. It is providing Laura with some financial help with equipment and consumables, and Cawthron is also pitching in with some research costs through its Internal Investment Fund.



A map showing the MPI warning area of Hawke's Bay

PARATYPHOID FEVER OUTBREAK IN HAWKE'S BAY

It seems that sewage-contaminated mussels were the culprit in the outbreak of Paratyphoid Fever in Hawke's Bay which had hospitalised five out of the six confirmed cases as at 26 September. By early October, ten cases had been confirmed with more tests pending. The link was mussels collected from Ahuriri, Napier, served at tangi on two local marae.

There were signs at the Port warning against collecting shellfish there.

Paratyphoid Fever is caused by a strain of *Salmonella* bacteria which can be transmitted to humans through the faeces of an infected person contaminating food and water.

The NZ Food Safety Science & Research Centre and partners are currently working with the East Coast Community of Tolaga Bay to help them evaluate safe/unsafe wild food sources such as shellfish. It seems this project is timely.



NZFSSRC awards two inaugural PhD scholarships to Laura Biessy & Rose Collis.





Rose Collis, PhD student

INVESTIGATING ANTIMICROBIAL RESISTANCE

Rose Collis grew up on a farm in Eketahuna and is one of two students awarded a PhD scholarship by NZFSSRC this year. The scholarships are funded from Massey University's contribution to the Centre. Her aim is to establish a baseline measure of the prevalence of antimicrobial resistance (AMR) in microorganisms in agricultural environments. Antimicrobial resistance is "up there" with climate change as a global existential threat. Generally, the more antibiotic medicines we use, the more likely it is that resistant organisms will be selected for and flourish.



Although the use of antibiotics in dairy farming is low by international standards because of our near 100% grass-fed production system, there is concern that "blanket dry cow therapy", a practice where farmers infuse the udders of the entire herd with antibiotics to prevent mastitis, could be accelerating antimicrobial resistance.

Furthermore, many antibiotic medicines crucial for human health are being used for veterinary care when there may be ready alternatives. Part of the plan to slow antibiotic resistance and buy time while we look for new medicines, is to make sure that the right antibiotic is used in the right situation, and to conserve the heavy hitters for when really necessary. The NZ Veterinary Association has a goal to phase out prophylactic use on farm by 2030, without compromising animal health and welfare of course.

Rose's work could be a vital reference to assess the burden of AMR in agricultural environments, with consequent advantages for the reputation of our exports. Her Master's thesis investigated, using culture-based methods, how to better differentiate *E.coli* serogroup O145, a potentially pathogenic bacteria commonly found in the gut of ruminants. Rose will use powerful metagenomics techniques to find, compare, and relate bits of DNA from her farm samples that confer antimicrobial resistance. One of her supervisors, Dr Patrick Biggs (Massey University), is an expert in this area. The computer is a mere instrument. You have to know what needle to look for in the haystack, and what questions to ask.

The rise of AMR is a global health concern requiring a holistic 'One Health' approach that considers the multiple interactions between humans, animals and the environment.



CONGRATULATIONS AND WELCOME

Congratulations and welcome to the new Minister of Food Safety Hon. Damien O'Connor and many thanks to the former Minister, David Bennett.





Dr Ruwani Kalupahana, PhD Supervisor, and Nilukshi Liyanagunawardena (right)

FOOD SAFETY IN THE 21ST CENTURY

Nigel French visited the beautiful nation of Sri Lanka in August to give the keynote address to a national workshop on veterinary public health. The aim of the meeting was to develop plans and policies to protect people from zoonotic diseases like *Salmonella*.

This was Nigel's second visit to Sri Lanka. Previously he went to advise the Vet School at Peradeniya, Kandy, on their public health curriculum. The relationship between our two countries came about when a twinning arrangement between the University of Peradeniya and Massey University was supported with funding from New Zealand's Ministry of Foreign Affairs and Trade.

Nigel's address gave a very comprehensive global picture of veterinary public health, covering the reasons for the increase in infectious diseases including globalisation, the encroachment of humans into wildlife habitats leading to the emergence of new infectious diseases like Ebola, SARS and MERS, anti-microbial resistance, and on the defence side, the application of new technologies such as genome sequencing.

He showed an interesting world map marking a relatively small circle of the Earth, centred in south China, within which more people live than outside. This high density zone, including India, Pakistan, Bangladesh, Sri Lanka, China, south-east Asia, and Japan, will be under even more pressure from population growth over the next two or three decades.

Nigel also discussed the consequences of climate change such as the changes in insect vectors,

and the emergence of *Leptospirosis* due to urine contamination of freshwater and exacerbating flooding events. He emphasised the need for scientists to work together seamlessly on the whole food and water chain - the One Health approach - and the importance of good advocacy and communication with the public and industry.

Nigel gave a second presentation on "Food Safety in the 21st Century" at the University of Peradeniya. As well as covering international trends and emerging risks, he illustrated genetic forensic techniques using New Zealand case studies: the *Campylobacter* epidemic in New Zealand, from the mid 1980s to 2006, traced to the poultry supply, and the 2000 outbreak of *Salmonella* in sparrows which quickly spread to humans on both islands of New Zealand.

As part of the very rewarding twin country relationship, funding has been arranged for PhD candidate Nilukshi Liyanagunawardena to study *Salmonella* transmission in poultry and the knock-on effect for public health in Sri Lanka. Nilukshi is busy right now taking samples from poultry in Sri Lanka, and from March 2018 will spend two years at NZFSSRC in Palmerston North, using whole genome sequencing to analyse them. Her supervisors include Nigel and mEpiLab Co-Director, Jackie Benschop.



A 'VIRTUAL' CENTRE

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

FUNDERS:



**MINISTRY OF BUSINESS,
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HĪKINA WHAKATUTUKI

Ministry for Primary Industries
Manatū Ahu Matua



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