

FEBRUARY/MARCH 2021

Food

New Zealand

NZ'S AUTHORITY ON FOOD TECHNOLOGY, RESEARCH AND MANUFACTURING

FEATURED IN THIS ISSUE:

Laboratory Supplies - Overview

The Allergen Collaboration is 10 years old!

UV Treatment of rolling berries - FIET Report

**ACTIVE AND INTELLIGENT
PACKAGING - OCEANS OF
POSSIBILITIES**

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Food NZ is distributed to all members of the New Zealand Institute of Food Science and Technology.

An online edition is shared internationally.

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Published by Peppermint Press Limited

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On the cover

Intelligent Packaging uses online platforms to
provide information to consumers and through
the supply chain while Smart Packaging
enhances product quality and shelf-life.

Image: Aphithana Chitmongkolthong, Dreamstime.com



**Next editorial and
advertising deadline:** March 19th 2021

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Overview: Ingredients for food companies

Foodtech Packtech Preview

Report on the Meat Industry AgResearch Workshop

EDITORIAL

In Praise of the Manufactory and of Industry

I was listening to Kim Hill interviewing someone and she asked a question about “industrial farming”. The adjective was clearly disparaging, industrial farming a bad thing, perhaps industrial anything a bad thing. What rot. I am sure if she thought about it more she might adjust....

My little pocket Oxford defines industry as “diligence, habitual employment in useful work; branch of trade or manufacture”. Spot on. This bracketing of a “branch of manufacture” with “diligence” and “useful work” catches our food process industry perfectly. And it is definitely a good thing.

You are at liberty to grow your own veggies and preserve them. But if you use potable water for irrigation and drive to Bunnings for seedlings, and use an electric dehydrator or a freezer, don't pretend you are more sustainable. Also, if you process at home don't be too sure your product is safer. You are at liberty to hunt or fish for your own meat, but similar caveats apply.

We are at liberty to buy direct from the producer at a farmers' market. It is fun. But most people will blow more CO₂ out of their SUV in buying that chutney, cauli and a coffee from a distant carpark than if that purchase were part of a big shop at a nearby supermarket.

Large-scale production, processing and distribution systems are so very efficient that usually the shopping trip and home cooking add more emissions to fruit and veg than everything else before that step.

I am unusual in believing that the manufactory (I like the old term) is mankind's greatest achievement. It is the sum of 100,000 years of technology development. Energy is captured then applied to break-down, build-up or modify all manner of material into useful artefacts. Consumers exchange money for products they value, at a price they agree. Manufacturers invest capital hoping for future profit. This brilliant system is how we built the modern world.

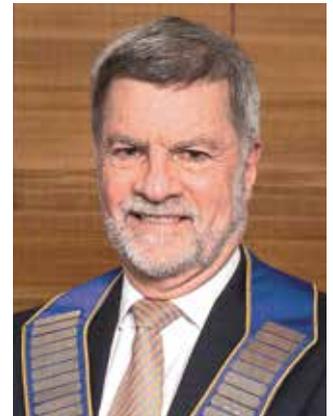
Of course, industry holds the same perils as fire. It can be used or abused, used well or poorly: with absolute freedom or within regulated boundaries.

Skilled regulation is part of a successful system.

When you work in a factory of today you inherit the lifetime's work of a million antecedents: their accumulated smarts gave us machines with interchangeable components running on standardised electricity and controlled by nearly universal software systems. The ways people organise and operate and how enterprises plan and execute, have been built up over only about 250 years. Factories are part of a global industry and of a national economy interlaced with suppliers, repairers, researchers and regulators. This is truly glorious.

For the price of just three or four years at University you can step into a factory and inherit the abundance of wealth that is this giant working system.

What is the biggest manufacturing industry in Europe? Answer: "Its food industry." In New Zealand we don't even need to ask. I don't pretend it is anywhere near good enough. Our job is to make it more efficient yet, to lose less nutrients, be more agile, to stay profitable. And to be more respected. I would like Kim Hill to believe, even before she has to think, that Industrial food manufacturing is a good thing.



*Richard Archer, President
NZIFST*

Richard Archer, President NZIFST

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2021

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In-Brief

In Brief is Food New Zealand's pick of the news stories about NZIFST members, about companies with relationships with NZIFST plus items that catch our interest.



Food Safety: the consumer is driving change

Consumers' evolving requirements are continuing to drive global changes in what we eat, how it is delivered and how it is produced or sourced.

To meet these demands, the food industry is adapting and innovating at pace. With stronger links across academia, investment, and science, the industry must maintain a consumer-centric approach and ultimately consumer confidence to support innovation.

These trends are changing the narrative. Whilst a modern lens promotes the need for environmental sustainability within food production and distribution, the balance between sustainability and continued food safety continues to be high priority for organisations as they navigate the risks and rewards associated with the use of innovative packaging for food products.

Resilient Supply Chain Management

The world's food supply needs continue to grow and having a secure and resilient supply chain is vital. Those at the coalface of supply chain management in New Zealand have stories to be told on surviving 2020, the challenges faced, and the lessons learned, including building agile supply chains, and deploying alternative solutions to maintain business continuity and of course food safety.

Enter Remote Auditing – the digital age of auditing

Like many things in 2020, auditing was significantly impacted, and the COVID-19 crisis has accelerated the adoption of remote auditing practices to maintain business continuity.

There are key considerations of remote auditing to consider and one of these is to identify effective digitised solutions to personalise and enhance internal processes within your organisation.

Consumer-driven change, resilient supply chain management and remote auditing will be discussed at the annual Food Safety, Risk and Compliance Conference – 16-17 March 2021. To view the full agenda, go to conferenz.co.nz/foodsafety

Discover commercial potential

This service scans journals, patents and conferences for key technology advances

Are you wondering if your competitors are working on some hot new technology you have missed, or that there is a technology that can be adapted to give you an advantage? Massey University now offers an emerging technology scanning service for the New Zealand food industry. We are looking for both quick wins (mature technology from other fields) and significant advances within existing fields and we can tailor a search for you.



Technology Scanning contact, Mikki Middleditch

In our last update, we noted the emerging options for:

- micron-sized gas bubbles to control viscosity of food liquids
- microwave drying at low-pressure
- ultrasonics in aging wines and spirits
- and an intriguing possibility of creating artificial colostrum.

Scanning since then has identified processes for:

- ultrasonic cavitation to treat specific milk proteins
- home food recyclers, a valuable future approach to food waste reduction
- a human milk oligosaccharide (HMO) shown to improve cognitive-perceptual processes
- processes for the extraction of bioactive substances from macroalgae.

Of interest in the macroalgae field is an extract rich in bioactive components, including carbohydrates, monosaccharides, oligosaccharides and polyphenols, acquired using a combination of ultrasound-assisted extraction and Enzymatic-Assisted Extraction. Other techniques, including Pulsed Electric Fields and Accelerated Solvent Extraction New Zealand, have also been applied to macroalgae, seeking more specific extraction, higher recovery and lower extraction (including waste treatment) costs.

We are taking advantage of the broad resources to which Massey has access, including our staff's extensive contacts within industry and academia.

To find out more, please contact Nikki Middleditch at the FoodPilot. Nikki can work out, in confidence, what exactly you want and what you can afford. N.Middleditch@massey.ac.nz.

THE FOODPILOT

It's on! Foodtech Packtech is back!



Foodtech Packtech is back this April

Locally and globally, the environment, freight, food safety and security are becoming increasingly relevant to consumers. As people start asking not just what is in their food, but what their food comes in, food and beverage manufacturers need support and expertise to ensure that they meet the demands of consumers and legislators alike.

In times of intense change a trade show with a history spanning decades provides vital support to the industry by showcasing new technology, new products, solutions and know-how. Meeting industry specialists is essential to helping you innovate and stay relevant.

After COVID changed so many schedules last year, XPO Group is thrilled to share that (all going to plan), almost twenty shows will go ahead this year, including Foodtech Packtech and the Materials, Handling and Logistics show from April 13 to 15.

With over 200 exhibitors, the show connects you with the experts and answers your most pressing food processing, manufacturing, packaging and distribution questions. You will meet suppliers, as well as industry experts, partners, and associations so you can help New

Zealand kick start the economy.

Whether you are looking to take your new plant-based food solution the rest of the world, launch the family's secret sauce or ensure that your multimillion-dollar global company is keeping up-to-date, this show will help you achieve your goals.

At no other time has an event like this been so important to the progression and profitability of the sector.

Take advantage of the local and global trust in New Zealand food and beverages and optimise your full supply chain potential by connecting with the experts, all under one roof.

Foodtech Packtech is an excellent opportunity to network, discover and get excited about the future of your business.

FREE TO ATTEND for all industry professionals simply visit www.foodtechpacktech.co.nz to register today.

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Research will investigate ways to use what are currently waste by-products of Hemp seed processing

Research to investigate high-value products made using hemp seed oil by-products

A Taranaki-based medicinal cannabis and industrial hemp venture is part of a group that will investigate ways to turn hemp seed hulls, for which there is little or no market currently, into high-value products destined for the global export market.

Greenfern Industries is part of a partnership awarded \$145,000 in cash and in-kind funding for research into products created from the by-products of hemp seed oil processing.

Greenfern will work alongside industry partners Callaghan Innovation and Hemp Connect as part of the project funded by the Bioresource Processing Alliance (BPA), which, in turn, is funded by the Ministry of Business, Innovation and Employment. BPA invests in research and development projects with the aim of generating additional export revenue for New Zealand by working with the primary sector to get better value out of biological by-products.

Greenfern's industrial hemp is currently grown in Central Otago and Taranaki and the company has plans to expand hemp seed farming to double its crops this year.

Hemp product suppliers, Hemp Connect have an agreement with Greenfern to share their capabilities in cold-pressing hemp oil from Greenfern's hemp seeds as part of the research process.

Greenfern has already teamed up with Sustainable Foods and the Riddet Institute Research Centre for the opportunity to turn hemp seeds into food products such as plant-based meat-substitutes and cosmetic products. The meat substitute has recently been trialled at Tank Juice Stores in Auckland, where the product sold out and received plenty of positive feedback.

"We have plans underway for rapid expansion, so we're keen to find added value opportunities for the by-products of hemp seed processing," said Greenfern managing director Dan Casey.

Previously, whole hemp seeds were cold pressed for hemp seed oil (as the main product) and hemp seed cake remained as the by-product with a high fibre content but not a particularly pleasant taste.

Now, Greenfern and its partners will discover how they can use the entire hemp seed, at a time when there is increasing interest in hemp heart (dehulled seed) that means a higher amount of hemp hull gets generated every year. Currently, the hemp cake and hull is difficult to sell so until now it has been stockpiled.

The project will look at ways to convert a significant volume of hemp hulls and other parts of the seed into higher value products such as antioxidants, oil, protein peptide supplements and water-soluble hemp protein for beverages of the future that are attractive to both the New Zealand and global food and nutraceutical markets.

"As well as creating new products for export, there is an opportunity to work on new or improved ways of processing, improving yields, and reducing waste. Given our commitment to sustainability, we're naturally really excited to be part of this research and development project," Casey said.

As part of the project, Greenfern Industries and Hemp Connect will provide the hemp seed, staffing, and marketing experience to work out production methods required to manufacture products and will explore new market opportunities and sales channels in New Zealand and Australia.

Research proves cartons are the most sustainable packaging choice

Study findings show if all of New Zealand's food and beverage products were in cartons, the climate impact would be up to 12 times less compared to alternative packaging options.

Tetra Pak has released research that revealed the carbon footprint of different food and beverage (F&B) packaging formats in New Zealand and Australia, with carton packaging having the lowest climate impact.

Commissioned by Tetra Pak and conducted by environmental consultants thinkstep ANZ, the report "Life Cycle Assessment of Beverage and Food Packaging in Australia and New Zealand" is a market-first, independently peer-reviewed comparison of the environmental impact of common packaging formats including cartons, PET bottles, rPET (recycled PET) bottles, HDPE bottles, pouches, tin cans, glass bottles and glass jars. The full report is available on the TetraPak website.

Andrew Pooch, Managing Director, Tetra Pak Oceania says it is important for F&B manufacturers to look at the environmental impacts of packaging across the entire life cycle of a package, in addition to end-of-life.

"This research examines the entire life cycle of each type of packaging – how it's made, what it's made of, how it's filled, how it's transported to the consumer, as well as how it's ultimately disposed of. The report revealed that the biggest contributor to carbon emissions is the material and production of the packaging."

Based on the amount of carbon dioxide released into the atmosphere per package of 1L fresh milk, the report found that carton packaging has a climate impact of 42 grams – more than 12 times less than glass packaging (520 grams), 5 times less than PET (221 grams) and less

than half that of HDPE (93 grams).

Cartons performed the best compared to other forms of packaging because of their material efficiency (using less material), their space efficiency (they pack together much better) and their mass is mostly renewable plant fibre.

Pooch says cartons have the potential to become the world's most sustainable food package. "They are mostly made of paper and cartons have a far smaller contribution to greenhouse gas emissions compared to other packaging types," he says.

Sustainable food packaging can play a strong role in bringing about the harmony between protecting our planet's ecosystem and meeting the human need for food. Today, the global food system accounts for 26% of global greenhouse gas emissions.

Pooch says the F&B industry needs to start talking about minimising packaging impact from cradle-to-cradle if we are serious about sustainability.

"A focus on recycling is important, but recycling alone is not going to solve global warming. The source of packaging materials, and their manufacture and transportation, are all important factors. Ideally, food and beverage packaging should maximise the use of carbon neutral and renewable materials to reduce their impact on nature," he says.



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Agriculture hangs tough in the pandemic

Kiwi ingenuity and a drive to “make it work” have been pivotal in New Zealand’s agriculture sector getting through the COVID-19 pandemic with relatively little impact, according to a new study by AgResearch and its partners.

Farmers and others working in the agriculture and food systems in New Zealand and Australia were surveyed or interviewed about the impacts of COVID-19 in the period through to June 2020, which included national lockdowns. While acknowledging overall negative effects, additional stress and pressures from the pandemic and response, only 47% of New Zealand survey respondents viewed the effect on their farms or businesses as negative over that period. A further 37% said the effect was neutral.

Much of New Zealand’s primary sector was able to continue working through the COVID-19 lockdowns and, unlike some other nations, its performance held up well. Export revenue from primary products for the period exceeded revenue from the previous year. Those interviewed in the New Zealand sector also identified some positives coming out of the pandemic experience such as better ways of working (including going paperless or doing online meetings), opportunities for new markets for their products and increased community appreciation of their sector.

“The term resilience is a buzzword that’s probably a bit overused. But it’s clear from our analysis that the in-built ability to cope with adversity through various means, find new ways of doing things and get on with the job, were important in how farmers and their supporting industries performed so well,” says AgResearch senior scientist Dr Val Snow.

“Many farmers were already dealing with drought conditions but were able to manage through the extra difficulties. We’ve seen those in other countries not fare as well. Some Kiwi farmers found being required to stay on their farms through COVID-19 restrictions meant they were actually more focused on their core tasks and their family life.”

One New Zealand farmer talked about the necessity to home-school the kids “meant they were involved in farming life and saw the decision-making process and us discussing real life events”.

Another experienced “indirectly, a change in attitude among public around how they value security of food production and therefore role of farmers in providing that food”.

Dr Snow says relatively high technology use and strong connections in the New Zealand sector also meant it was well-placed to respond to the pandemic, while overseas demand for its products remaining strong was also critical.

AgResearch scientists and NZIER (New Zealand Institute of Economic Research) worked with several science organisations in New Zealand and Australia as part of this collaborative research. The full details in the open access published article can be viewed at: <https://www.sciencedirect.com/science/article/pii/S0308521X20308866?via%3Dihub>

Meat Industry Workshop in March

The 2021 Meat Industry Association and AgResearch Meat Innovation Workshop will be held in Palmerston North on Tuesday 16 and Wednesday 17 March 2021.

This well-established annual event is the industry research and development forum for exchanging ideas and scientific developments amongst meat industry professionals and scientists. In 2021 MIA and AgResearch will be combining to run one single event, rather than two back-to-back workshops as in previous years, to present results from current research projects and discuss opportunities for new research and development.

The agenda for the workshop will be published in early February 2021.

Global Food and Drinks Trends for 2021

Mintel, the experts in what consumers want and why, has announced three key trends for the global food, drink, and foodservice industries, including analysis, insights, and recommendations centred around the 'now' (next 12 months), the 'next' (18 months+), and the 'future' (five+ years) of consumer behaviour:

The three key trends are:

Feed the Mind: Innovative food and drink formulations will offer solutions for mental and emotional wellbeing that will create a new foundation for healthy eating. As the singular focus of avoiding COVID-19 fades, people will make more serious commitments to reduce the health risks associated with unhealthy eating, become more interested in mindful and intuitive eating, and seek proof and incentives through the use of technology.

"The COVID-19 global pandemic has made consumers recognise that wellbeing is a vital concern. In the coming years, consumers will be looking for more products and services that offer mental and emotional health benefits.

"Functional formulations and emotionally engaging, multisensory products will help food, drink, and foodservice brands command a larger share among a myriad of mental and emotional health options. We predict that innovative food and drink formulations will help people learn how diet can impact mental and emotional health, which will lead to new interest in psychology-based approaches to healthy eating."

Quality Redefined: Brands will be challenged to respond to new definitions of trust, quality, and 'essential'.

Expect to see consumers look for approachable upscale meals for special 'hometainment' occasions. Expect to see brands and retailers launch appropriately priced products with ethical or environmental claims and that consumers will increase their expectations for contactless retail that will expand to include experiential services. Over the next five years and beyond, brands and operators that invest in seamless retail and equitable access to healthy food will come out on top.

Consumers will expect time-saving, hygienic, and adventurous convenience food, drink, and foodservice. In the next few years, brands will also be challenged to respond to new definitions of quality and ensure ecommerce is accessible to shoppers of all socioeconomic levels. The focus on getting the best value for one's money will motivate brands to be more transparent about product price by providing details about the ingredients, processes, and people that are reflected in a product's price."

United by Food: Food and drink brands can balance a person's need to feel unique and special with the desire to be part of communities of like-minded individuals.

"Consumers' understanding of the community has been strengthened by COVID-19. Recognising the importance of connection and support, consumers will organise in like-minded communities for socialisation and camaraderie. Food, drink, and foodservice brands can take advantage of their positions as common interests and passions to which consumers can tie their identities and actively bring individual fans together."



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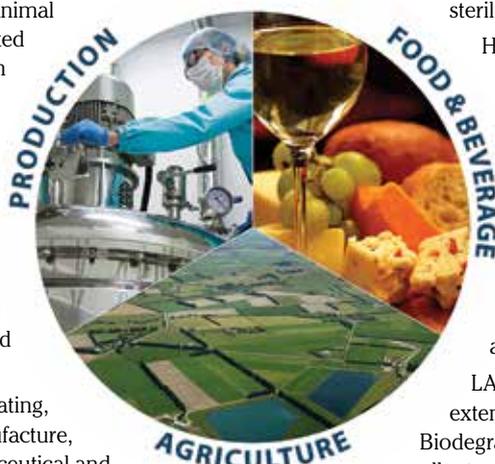
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Analytical tools for measuring Food Quality

The Phenom Desktop Scanning Electron Microscope (SEM) is an essential tool used to study the relationship between food processing conditions and morphological changes of food components, as the structure of foods can influence nutritional value.

Phenom XL G2 desktop SEM is easy to use and offers superfast imaging with fully integrated X-ray analysis to enable both food structures to be physically examined and their elemental composition determined. With the fastest time to image (less than 40 sec from sample loading) up to 200,000 times magnification and <10nm resolution, the Phenom SEM is an essential tool for any laboratory.

New automation solutions for quality control (QC) enable manual, repetitive tasks to be automated and a high volume of samples to be quickly processed. Particles, pores, fibres or large SEM images up to 100 by 100 millimeters can be automatically characterised and foreign contaminants identified and evaluated for chemical composition.

Malvern Mastersizer particle size analyser is used to determine particle size and size distribution for foods and additives. Particle size defines mouth feel and is important for controlling manufacturing costs.

The Mastersizer 3000 is the premier instrument on the market for design, performance and software user experience. With a dynamic range spanning 0.01 to 3500 microns, the Mastersizer 3000 delivers precise, robust wet and dry particle size measurements tailored to the operator's application needs. A small footprint, exceptional dry dispersion capabilities and intuitive software designed to ease user



Malvern Mastersizer particle size analyser, available from ATA Scientific

workload have resulted in its enduring appeal and propelled the system as the unit of choice.

Malvern Zetasizer Ultra is used for the measurement of particle and molecular size, particle charge and particle concentration. The system can be used to determine optimal concentrations of food additives for desired taste and smell performance or to improve emulsion stabilisation of flavourings.

The new Zetasizer Ultra delivers enhanced speed and ease of use, accelerating sample throughput. Multi-Angle Dynamic Light Scattering (MADLS) technology provides higher resolution, more complete particle size distributions and calibration-free particle concentration analysis to enable even greater insight into your samples.

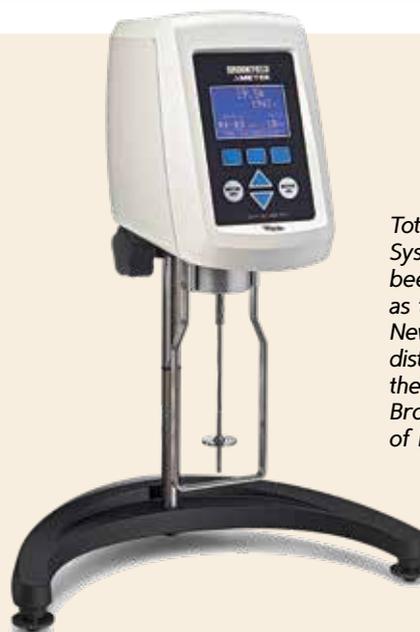
For further details contact ATA Scientific Pty Ltd. www.atascientific.com.au

Total Lab Systems

Total Lab Systems has been appointed as the exclusive New Zealand distributor for the Ametek Brookfield range of viscometers, rheometers, texture analysers and powder flow testers. The agency is backed-up with full inhouse or on-site calibration and service support.

Brookfield instruments have been the world standard in viscosity measurement for over 85 years. Their expanding portfolio includes texture, moisture, toxic gas and powder analysis instruments for accurate material characterisation measurements, making their instruments ideal for applications in many industries.

The Brookfield range of products complements Total Lab's existing portfolio of food related instruments – A&D (balances and moisture analysers), Rudolph Research (refractometers and density meters), SI Analytics (pH and automatic titrators), MISCO (handheld refractometers) and Velp Scientifica for protein, fibre and fat and oil testing.



Total Lab Systems has been appointed as the exclusive New Zealand distributor for the Ametek Brookfield range of instruments

Food Tech Solutions

Megazyme for Dietary Fibre Measurement

Megazyme is focused on fibre. Their scientists are leaders in the field, their methods are internationally recognised and accredited, and the products are world class.

There is huge interest in the topic of Dietary fibre (DF) at the moment due to the need for factual nutrition labelling requirements.

Over the past 30 years, Megazyme has established itself as the global leader in the area of DF methodology with their Megazyme Total Dietary Fibre (TDF) enzymatic kits. The TDF kit determines soluble, insoluble and TDF content in processed foods and raw materials, such as cereal products, fruits and vegetables. The LOD of this kit is 0.5g/100g with a total assay time of ~100 mins.

DF is a mixture of complex organic substances, including hydrophilic compounds, such as soluble and insoluble polysaccharides and non-digestible oligosaccharides, as well as a range of non-swellaable, more or less hydrophobic compounds such as cutins, suberins and lignins. This definition has changed as the body of scientific knowledge in this area has increased.

The Megazyme TDF enzymatic kits are referenced in the recommended AOAC Method 985.29 and 991.43, and AACC Method 32-05.01. The major advantage of the Megazyme kit is the inclusion of high purity enzymes, devoid of interfering activities. All Megazyme TDF enzymes are supplied in ready-to-use, stabilised, liquid format.

Megazyme have a Dietary Fibre Portal here <https://www.megazyme.com/focus-areas/dietary-fiber-portal>

Megazyme Advantages:

- Simple format
- All reagents stable for >2 years
- High purity/standardised enzymes employed
- Very competitive price (cost/test)
- Mega-Calc™ software tool; FREE for hassle-free raw data processing

Find out what sets Megazyme apart in the measurement of DF and discover how Megazyme can help your business perform best-in-class dietary fibre analysis. Contact Food Tech Solutions today.

Megazyme for measuring Dietary Fiber



The Megazyme TDF (Total Dietary Fiber) kit determines soluble and insoluble content in processed foods and raw materials.

- Megazyme TDF enzymatic kits are used in the recommended AOAC Method 985.29 and 991.43, and AACC Method 32-05.01.
- LOD of the kit is 0.5g/100g with a total assay time of ~100 mins.
- Very competitive price (cost /test).
- All reagents stable for > 2 years.
- Mega-Calc™ software tool; FREE for hassle-free raw data processing.



Find out how Megazyme can help your business perform best-in-class dietary fiber analysis. View Megazyme's Dietary Fiber Portal at <https://www.megazyme.com/focus-areas/dietary-fiber-portal>

Food Tech Solutions are New Zealand agents for Megazyme.

For more information and to order Megazyme kits online [Click here](#)

T: 09 576 7326

W: www.fts.co.nz

E: sales@foodtechsolutions.co.nz



Lab Supply
are agents for
Eppendorf

Lab Supply

New Zealand owned and operated, we are independent importers and distributors of scientific equipment and consumables from some of the world's leading brands. We also support what we sell with in-house servicing, calibration and repair capabilities for a wide range of laboratory equipment. But most of all, we pride ourselves on being responsive and proactive, answering requests as quickly as possible and never leaving customers in the dark.

We are proud to be an agent for Eppendorf here in New Zealand. Our staff have the capabilities and knowledge to help you find the right product and offer technical advice and make recommendations on the use of all Eppendorf equipment.

We offer a comprehensive list of servicing and calibration options for your Eppendorf equipment, including centrifuges, thermal cyclers, pipettes and liquid handling. Our in-house engineer can also install your instruments and train staff as we are experienced in the set-up of new labs and testing of equipment to ensure it works within the necessary parameters.

If you are in the market for any of Eppendorf's wide range of quality products, give us a call!



LactoSens® R enables fast & reliable lactose results

Chr. Hansen

With consumer dietary preferences ever-evolving, the demand for lactose free dairy products is booming – in 2019 New Nutrition Business reported that lactose-free milk sales were growing at 14%. We also know that consumers are increasingly focusing on the safety and quality of the food brands they purchase and consume. Trust and transparency from food companies is paramount (Red Associates for Chr. Hansen).

LactoSens® R is a new biosensor assay kit for the determination of lactose in a wide range of lactose-free and low lactose dairy products. Applications include milk, yoghurt, cream, powdered milk, fresh cheeses and even flavoured milk, which up until now had been challenging. This kit is suitable for all commonly used lactases and ensures robust documentation of low lactose or lactose free claims for every batch.

LactoSens® R enables fast and reliable lactose results:

- Prompt results in few minutes, enabling increased productivity and allowing for immediate product release
- Highest precision due to the robust reader and factory calibrated sensors
- Validated against HPLC method - the only rapid method which has obtained this validation
- Detection limit of 0.008%
- Resilient and robust against historic interferences such as vitamins, sugars, fruits, coffee, chocolate and other ingredients
- Intuitive software to ease use and minimize training
- Automatic generation of a PDF for documentation as well as enabling export of data in .csv format for storage and future analysis and reference.

LactoSens® is the result of more than 10 years of research and the core technology platforms are protected by 2 different patents. The sensor production and kit assembly are all accredited by ISO 9001 certification.

FOSS Analytical Solutions

FOSS is a global provider of high-tech analytical solutions used in different segments of food industry:

Dairy

NIR and FTIR analysis are automated reference analysis support manufacturers in many aspects of the complex dairy process. From optimising fat content in ice cream mix to screening incoming raw milk for adulteration, analytical technology used at key measuring points helps to streamline production and save money.

Meat

NIR analysis of meat and in-line X-ray analysis as well as reference analysis: meat analysis takes many forms from the lab to the production line. Robust instruments designed for testing fat directly in the meat production line are becoming increasingly essential for profitability while at-line and lab NIR solutions are providing new levels of accuracy and sophistication in measuring multiple quality parameters to meet labelling requirements and consumer preferences.

Wine

FTIR testing of wine and grape must for multiple parameters including sulphur dioxide is complementing tradition. Even in an industry like wine, driven by tradition and sensorial know-how, adding a new level of automation helps ensure quality and consistency.



The FOSS MilkoScan™ FT3. A new, intelligent approach to dairy analysis

Grain

NIR and reference analysis of grain and flour and all manner of oilseeds, beans and pulses. Grain is where FOSS started with a grain moisture tester in 1956 and continues today with the latest in connectivity and in-line options to check product quality.

And much more!



The new Aqualab 3 from Meter Food, supported by Mätt Solutions in NZ, breaks the speed barrier for Water Activity testing

Mätt Solutions

FAST - One Minute Water Activity

Normally, measuring water activity takes a significant amount of time. The sample must come to equilibrium in the instrument before a reading can be taken. Depending on the sample, that can take 2-5 minutes—even longer for some products: products high in fat, or volatile compounds. There hasn't been a way around "equilibrium time" or "dwell time." Until now.

The new AQUALAB 3 from Meter Food and supported by Mätt Solutions in NZ breaks the speed barrier. Using SKALA-powered predictive AI, it delivers both water activity and moisture content readings on a single sample in one minute, even when measuring volatile compounds.

AQUALAB 3 lets you know within one minute whether the batch will pass or fail, helping you avoid costly recalls or batch scrapping by making fast decisions at the line to address issues before your process goes out of control. Get "Alarms" or "Outside Operating Limits" indicators within 60 seconds and use the predicted final values to adjust belt speed, oven temperatures, water content in products and other critical parameters before they result in rework or scrap. Fast water activity measurements offer the most precise way to monitor and control moisture at the line saving you costs by optimising your process.

When paired with the SKALA online tool, the Aqualab 3 allows you an unprecedented level of batch, ingredient and final product track-and-trace capability that will eliminate costly reworks, make auditors love you and place profit firmly where it belongs – back in your pocket.

Email: info@matt.nz Visit: www.matt.nz





Optimise your food analysis using Metrohm instrumentation

Metrohm New Zealand

Metrohm New Zealand provides experience and knowledge to the food and beverage industry, expertise gained through years of supporting customers with a complete line of robust, efficient, and sensitive instrumentations.

Here are four ways to optimise your food analysis using Metrohm instrumentations. From sample preparation, nutrient testing to labelling, using various applications and techniques.

1. Salt Analysis – Metrohm provides a cost-efficient, fast sodium analysis with the Eco Titrator system. The Eco Titrator Salt Plus provides the complete package for the analysis of chloride in a wide variety of food samples.

2. Allergen Testing Solutions – With the range of enzymatic/chemical test kits from BioSystems you can now test your food and beverage

production for a wide range of constituents. ELISA kits analyse the presence of substances at very low concentrations, due to the specificity of antigen-antibody binding reactions.

3. Importance of homogenisation – Samples are often very complex and need to be homogenised and reduced to a suitable particle size depending on the chosen analysis method. RETSCH offers a variety of mills and grinders suitable for the different requirements of food analysis.

4. Qualitative and quantitative analysis – Composition and authenticity of food products can be done non-destructively with Raman spectroscopy. Examples include the presence of contaminants in food, identification of food additives, and ingredients including cellulose, sorbitol, stearic acid and starch. Raman spectroscopy also quantifies the composition of fatty acids in food products, as well as other components in food, such as flavours.

Onelab: Results Matter

Onelab offers a range of products from laboratory consumables through to premium instrumentation for the lab and production environments.

Globally, there is increasing demand for final product testing and cost savings in the manufacturing space. This, combined with continued advancements in speed, accuracy and high throughput, means Onelab is well positioned to support the New Zealand market in its need for high quality, well supported products that are imperative to our customers success.

- BUCHI - Kjeldahl, NIR, Evaporation, Freeze Dryers, Fat Extraction etc
- METTLER TOLEDO laboratory range – balances, electrochemistry, Spectrophotometers, titrators, density, refractometers, pipettors etc
- Gerber Instruments - Dairy Testing equipment
- INTEGRA – Media Preparators, plate pourers, dispensing pumps, vacuum aspirators
- OMNI International – Homogenisers and bead mills
- SSI Bio and Technoplas - Plastic laboratory consumables
- Brand - Consumables including volumetric glass, digital burettes, bottle top dispensers
- IKA – Mixing, shaking, stirring, viscometers etc
- Grant Instruments – water baths, bench top equipment, dataloggers etc
- Labconco – cleanroom hoods, dry block evaporators, vacuum concentrators
- INTERSCIENCE – Blenders, diluters, pourers, colony counters, dispensing pumps etc



- Personal Protection Equipment – mediwipes, masks, gloves etc
- Milestone - Sample prep for metal analysis, fat extraction
- NEW: SEAL Analytical – discrete and segmented flow analysers, robotic sample prep automation
- NEW: Hettich – centrifuges and incubators
- Service – Onelab Service all brands we sell – Nationwide!

Onelab believe Results Matter, so contact us for your Laboratory Testing requirements.

BUCHI ProxiMate
Rapid measurement of parameters such as protein, moisture, fat, carbohydrates, ash and many more...

The Swiss BUCHI at-line NIR solution shines through with the following features:

- **EXTREMELY ROBUST** - works in harsh environments (IP69 protection)
- **EASY TO USE** - Handsfree with automatic calibration function!
- **FOOD AND FEED** instrument -with ready to go calibrations

Fast quality control of batch samples reduces downtime in production.

The intuitive user interface allows operation by everybody and a wide selection of precalibration packages make it suitable for all applications.

ONLINE OPTIONS ALSO AVAILABLE



Demo now available, click here to register your interest for a demonstration



Onelab Ltd onelab@onelab.co.nz 09 414 5599 or 0800 ONELAB



Paperless inspection applications offer a portable, ready-to-use solution for those who want to maintain high standards both in the field and in the facility

Pervidi paperless inspection applications

Paperless Inspection Applications are used across all industries, no matter where businesses are located, from engineers to laboratory, environmental health officers, QA managers to maintenance coordinators and manufacturing plant supervisors.

These paperless applications remain crucial to improving performance, saving time and money while increasing future business efficiency and safety.

The point of difference in choosing the right paperless application comes when considering the ability to customise to your organisation's needs. Be it meeting industry standards, the ability to access data off-line or the opportunity to provide quality reporting on a custom built list of assets.

Consider the functions you would like to automate based on your current paper checklists (e.g. GMP, Laboratory Assessment, HACCP, Safety QA etc.) You may want to create a functionalist wish list. The list may include:

- History of previous inspections
- Checklist with a rating option (e.g. 1-10)
- Pass/fail option for each item
- Ability to schedule follow-up inspections
- Speech to text functionality
- Ability to take photos, and annotate them, to identify issues of concern
- Access to manuals, policies, state, federal and local Acts and Standards (eg Food Standards Code)
- Comprehensive and accurate reporting on all aspects of inspections
- List of follow-ups required in order to allocate and foresee potential workload issues.

By automating your systems you are removing the guess work, simplifying processes, all while ensuring compliance when and where required. www.pervidi.com.au

Let's get smart about packaging

Nerida Kelton MAIP, Executive Director – Australian Institute of Packaging (AIP), Vice President (Sustainability & Save Food)– World Packaging Organisation (WPO)

Active and Intelligent Packaging

You may have heard the terms Active & Intelligent Packaging but not really understood the role that these solutions can play in extending shelf life, monitoring freshness, displaying information on quality, improving safety, and enhancing consumer convenience.

Smart Packaging systems not only monitor food quality and safety but also provide a digital footprint to track and trace food all the way from pack-houses to households. Active and Intelligent Packaging Systems can also ensure that food waste is minimised all the way across the supply chain.

Active Packaging provides functionality to extend shelf life and actively changes the condition of the packaged food via additives incorporated into the substrates or inside face of the packaging. Depending on the required outcome, the additives release, or absorb, into the food, or surrounding environment, to not only improve shelf life but also quality, safety and sensory traits of the food. Active Packaging can be designed to retain or eliminate Oxygen, Carbon, humidity and odours and can release compounds to the food such as CO_2 , antimicrobials, antioxidants, aromas and more.

Active Packaging technologies comprise numerous solutions including Modified Atmosphere Packaging (MAP), Equilibrium Modified Atmosphere Packaging (EMAP), Spoilage/Pathogen Indicators, Moisture Absorbers, Oxygen/Ethylene Scavengers, Carbon Dioxide Emitters and Scavengers, Flavour/Odour Absorbers, Preservative Releasers, Ultraviolet Barriers and Antimicrobial Packaging and more.

Intelligent Packaging communicates product changes and monitors the condition of the packed food to provide information about the quality of the food from farm to plate. Intelligent Packaging technologies include Time Temperature Indicators (TTI's), Shelf-Life Sensors, colour-changing thermochromic inks and labels and more.

Communicating through the supply chain

Intelligent Packaging can contain either an external or an internal indicator for the sole purpose of sensing, detecting and recording pre-selected information about the food all the way across the supply chain. This information can identify whether any environmental changes have occurred to the product during the materials handling, logistics and transportation of the goods to the consumer. Intelligent Packaging systems can also be used for tamper evidence, product protection, and as an anti-counterfeiting device, all the while providing real-time data for track and trace. These systems are an innovative digital information tool that can view the product across all sectors of the supply chain and ultimately communicate the full lifecycle of a product direct to consumers.

The Active & Intelligent Packaging Industry globally continues to develop innovative systems that can improve quality control, extend shelf life, optimise freshness, control shipping and transportation



The Grape N' Go punnet developed by Result Group and Navi Co Global in Australia is packed with EMAP controlled-atmosphere technology in the punnet allowing product respiration and extension of shelf life

routes, access food that has spoiled at any point within the supply chain and communicate with consumers. Consumers can also reap the benefits of being informed about everything from the freshness of the product, whether the food has been stored at the right temperature, through to whether it is fit to eat or about to spoil.

Examples of innovative Active & Intelligent Packaging Solutions

Grape N' Go EMAP punnet

The Grape N' Go punnet developed by Result Group and Navi Co Global in Australia was designed to minimise food waste and to enable consumer convenience. The Grape N' Go product is packed with EMAP controlled-atmosphere technology in the punnet allowing product respiration and extension of shelf life. The structure of the lidding film has two laminated layers with perforated laser holes on the surface of the lid to allow for optimal O_2 permeability. These non-visible-to-the-eye holes allow product respiration and support an extended shelf life. Grape N' Go's reclosable lidding employs a special, uncured adhesive layer that is exposed when the consumer first opens the multi-layered reclosable lid. Once exposed, the layer maintains its adhesive properties for up to 20 uses, even under challenging, cold conditions of refrigerated storage.



Consumers can read a package QR code that uses a GS1 Digital Link which connects to the item's digital identity in the EVERYTHING platform revealing batch-level information on the product

Longer lasting avocados

Mission Produce, an advanced avocado network, partnered with Hazel Technologies to launch AvoLast by Hazel®, a new shelf-life extension programme that enables avocados three extra days of optimal ripeness on average. The AvoLast programme uses a (US) quarter-sized biodegradable and food-safe packaging insert that temporarily blocks an avocado's ethylene receptors and slows the ripening process. By increasing the shelf-life of both hard and ripe Hass avocados, it aims to reduce retail throwaways, in turn increasing profit while creating more positive consumer experiences that drives category growth.

Innoscentia expiration date labels

Innoscentia have developed expiration date labels that offer real-time monitoring of food quality to help reduce waste and alert consumers to spoiled food. The technology works by measuring the Volatile Organic Compounds (VOCs) which are emitted as gases inside the packaged meat. As the gases begin to signal that the meat is degrading, sensors in the labelling can connect to a consumer's smartphone or digital system to advise them that their food is about to spoil. The technology can estimate when an expiry date is likely to occur.

Mowi's end-to-end traceability platform for Salmon

Mowi, the world's largest producer of Atlantic salmon, worked with EVERYTHING to help launch its brand with 100% transparency, powering food traceability and provenance for its product lines. Using a Smartphone consumers can scan the package to understand the full lifecycle of the salmon. On each item's packaging, there is a consumer-scannable QR code that uses the global standard, GS1 Digital Link which connects to the item's digital identity in the EVERYTHING platform revealing batch-level information on the Salmon.

Real-Time Shelf-Life Indicator for meat, poultry and fish

Blakbear have developed a paper-based electrical gas sensor that indicates how much shelf life is left for packaged meats, poultry and fish in real time. Consumers can access the shelf-life data when they scan the RFID tags with their smartphones, notifying them of how much shelf life is remaining. It will also provide the consumer with information on whether the product is still safe to eat or should be discarded.

100 million connected packs rolled out for UK dairy brand

Yeo Valley Organic, in partnership with SharpEnd, have rolled out connected packaging across all products as part of the new 'Put Nature First' brand platform. Working with connected-consumer agency SharpEnd, Yeo Valley Organic says it can now engage directly with consumers through its most scalable media asset. Consumers will be able to use their smartphones to scan the 'Moo-R' QR codes which can be found on over 100 million products. Yeo Valley wanted to inspire others about the benefits of organic and how it is one crucial factor in addressing the climate crisis. The content will encourage everyone to put nature first in their own small way, whether that is buying British organic dairy more often, reducing food waste or encouraging wildlife into their garden.

Anti-counterfeiting and serialisation for premium watermelons

Kezzler's track and trace technology includes high-value locally produced watermelons and rice being produced at the government sponsored National Model Agricultural Industrial Park located in Hanting, Shandong. Kezzler's technology includes the attachment of a unique ID to every product, that is, every watermelon, to protect the premium product from counterfeiting. The system uses a patented algorithm, called a DME (digital massive encryption) to produce many IDs in a short time, to be used for serialisation via QR codes, RFID, etc. Consumers can use WeChat to scan the packaging, from their smartphone via a User Interface. This will also give them access to information about how the product was grown, and when it was harvested.

Continuing development

It is evident when looking at all of the latest innovations in Active & Intelligent Packaging that this technology is advancing rapidly and can provide significant benefits to everyone along the value chain. If you are interested in ensuring the highest level of food safety, quality, freshness, the ability to minimise unnecessary food waste along your supply chain and communicate directly with your consumers then consider Active & Intelligent Packaging systems.

Successes in Worldstar Packaging Awards



Planet Protector Packaging Lobster Protector - winner in the Food Sector of the WorldStar Packaging Awards

The Australian Institute of Packaging (AIP) is pleased to announce that ten Australian and New Zealand companies have been internationally recognised with thirteen awards across seven categories in the prestigious WorldStar Packaging Awards, which are run by the World Packaging Organisation. Winners from Australia and New Zealand combined, received the fourth highest amount of WorldStar Packaging Awards in the world behind Japan, China and USA which is an incredible feat for the ANZ region. The ANZ winners are winners from the annual Packaging Innovation & Design (PIDA) Awards program which is the exclusive feeder program for the two countries into the WorldStar Packaging Awards.

The categories where ANZ designs were recognised include Food, Beverage, Labelling & Decoration, Health & Personal Care, Household, Packaging Materials & Components and Transit. Planet Protector Packaging was recognised in three categories and NCI Packaging/Birdstone Collective in two categories. (NB: The WorldStar Special Awards, of which there are a number of ANZ entries, will not be announced until the 2021 virtual WorldStar Awards ceremony)

The 2021 WorldStar Packaging Award winners for Australia and New Zealand are:

WorldStar Packaging Awards Food Category:

- Planet Protector Packaging for the Lobster Protector
- Disruptive Packaging for Uniqcor for cold chain environments



Platypus Print Packaging was awarded in the Food Sector of the WorldStar Packaging Awards for the Youfoodz Meal Kit

- Platypus Print Packaging for the Youfoodz Meal Kit
- Sealed Air Brand Protective Packaging for the TempGuard kerbside recyclable packaging for pre-packaged, temperature sensitive goods

WorldStar Packaging Awards Beverage Category:

- Coca-Cola Amatil for 100% recyclable rPET bottles
- Ecolean for the Bannister Downs Dairy WA chilled pasteurised range
- Brownes Dairy for Australia's first renewable gable top milk carton

WorldStar Packaging Awards Household Category:

- Pact Group for New Zealand's Earthwise brand of PCR 75% rHDPE household cleaning range
- Birdstone Collective & NCI Packaging for the DuluxGroup Cabot's Ready Bucket

WorldStar Packaging Awards Packaging Materials & Components Category:

- Planet Protector Packaging for the Lobster Protector

WorldStar Packaging Awards Health & Personal Care Category:

- Pact Group for the New Zealand Earthwise Glow Labs brand of PCR 100% rPET bottle range



Pact Group for Earthwise rHDPE - winner in the household category of the WorldStar Packaging Awards

2021 PIDA Awards now open

The Australian Institute of Packaging (AIP) have designed the Australasian Packaging Innovation & Design Awards (PIDA) to recognise companies and individuals who are making a significant difference in their field in Australia and New Zealand.

Entries are now open for the 2021 Australasian Packaging Innovation & Design Awards for Australia and New Zealand.

The PIDA Awards are the exclusive award programme for all Australian and New Zealand entries into the prestigious WorldStar Packaging Awards, which are coordinated by the World Packaging Organisation (WPO).

2021 PIDA Categories include:

- Design Innovation of the Year: Food
- Design Innovation of the Year: Beverage
- Design Innovation of the Year: Health, Beauty & Wellness
- Design Innovation of the Year: Domestic & Household
- Design Innovation of the Year: Labelling & Decoration
- Design Innovation of the Year: Outside the Box
- Sustainable Packaging Special Award
- Save Food Packaging Design Special Award
- Accessible Packaging Design Special Award
- Marketing Special Award
- Young Packaging Professional of the Year
- Industry Packaging Professional of the Year

To download the entry forms and criteria visit <http://aipack.com.au/2021-pida-awards/> or email pida@aipack.com.au for further information

Applications are now Open for the 2021 Australasian Packaging Innovation & Design Awards Deadline: 5 March 2021. To download the entry forms and criteria visit <http://aipack.com.au/2021-pida-awards/> or email pida@aipack.com.au for further information



- Food • Beverage • Health, Beauty & Wellness • Domestic & Household
- Labelling & Decoration • Outside of the Box • Sustainable Packaging Design
- Save Food Packaging Design • Accessible & Inclusive Packaging Design • Marketing
- Young Packaging Professional of the Year • Industry Packaging Professional of the Year

EXCLUSIVE ENTRY POINT: WORLDSTAR PACKAGING AWARDS



**APPLICATIONS NOW OPEN
CLOSING 5 MARCH 2021**

pida@aipack.com.au

www.aipack.com.au

FIET Project 13: UV technologies for shelf life extension in fresh produce

Authors: Professor John Bronlund¹, Dr Syahmeer How¹, Dr Mario Alayon-Marichal², Ms Shirley Miller³, and Dr Gonzalo Martinez^{1*}

¹Massey University, Palmerston North; ^{1*}formerly Massey University, Palmerston North; ²The New Zealand Institute for Plant and Food Research Limited (Plant & Food Research), Palmerston North; ³PlantWise Ltd, Tauranga



Dr Gonzalo Martinez, (formerly Massey University)



Professor John Bronlund



Dr Syahmeer How (How)



Dr Mario Alayon-Marichal, Plant and Food Research



Shirley Miller, PlantWise Ltd

Ultraviolet light can extend shelf life in fresh produce such as berries and grapes. It acts in two ways: microbial inactivation of spoilage organisms and initiating stress responses that result in increased antioxidant production. Commercial UV treatment is used in water treatment and is gaining traction in less transparent fluids such as juices, wastewater and wine. Its successful application in solid produce such as berries or cherries presents new challenges as it requires even exposure to the whole fruit surface to be effective.

FIET Project 13 focuses on the control of the movement of berries in processing lines to achieve even UV exposure for shelf life extension.

Team update

This project was initiated by [Dr Gonzalo Martinez](#), who led the research, design and testing of prototype treatment systems, interactions with industry partners and the development of mathematical models for the movement and UV exposure of berries during treatment. In August 2020 Gonzalo left Massey for Europe. We truly appreciate all the hard work and effort he put into the research and although he was keen to see the project through to completion, other opportunities intervened. Nothing is ever a problem to Gonzalo and he is a master at picking up new modelling approaches and applying them to new applications. The wider Massey engineering, postharvest and packaging research teams will miss his significant contributions. We wish Gonzalo the best for his future endeavours and have no doubt he will have a brilliant research career.

[John Bronlund](#) has picked up the mantle to lead the project through to completion by July 2021. Syahmeer How has been appointed to complete the design, implementation and testing of the final prototype for the project. How (as he is known) has recently submitted his Riddet Institute funded PhD in bioprocess engineering and brings experimental and modelling skills to the project. How has already got up to speed on shelf life testing, UV treatments and spoilage organism microbiological assays.

[Dr Mario Alayon-Marichal](#) at Plant and Food Research is investigating how UV and other novel treatments, such as ozone, influence fruit polyphenol and ascorbic acid levels. These compounds are important in extending the product shelf life and provide nutritional benefits. He found that the ascorbic acid is stable during ozone treatment of blueberries and polyphenols, especially anthocyanins, increased significantly during storage after treatment.

Results from preliminary shelf life extension experiments using ozone, by Ann Gie Teo from the Singapore Food Technology class in her final year research project, suggest ozone is a viable technology and worthy of future research.

[Shirley Miller](#), a horticultural consultant at Plantwise, is another key member of the team. She provides industry insights and links the project to growers, packers and marketers of berries. Through Shirley, we have built strong partnerships with Berry Co, Miro LP, Bella Berries, Berry Packers Ltd (BPL) and Apatu Group Ltd.

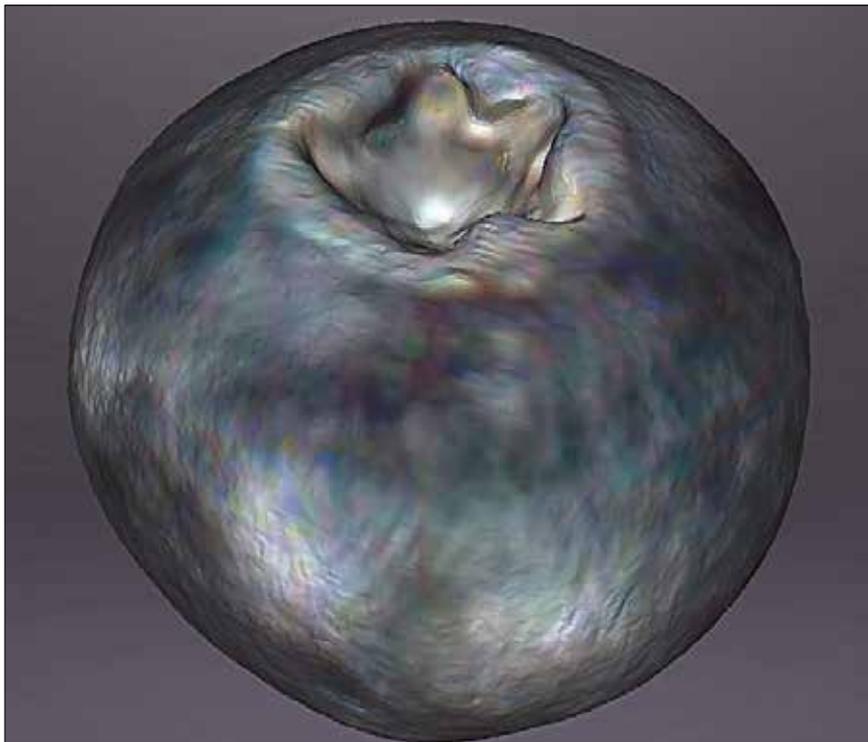


Figure 1. An example of a 3D scanned blueberry from the shape library

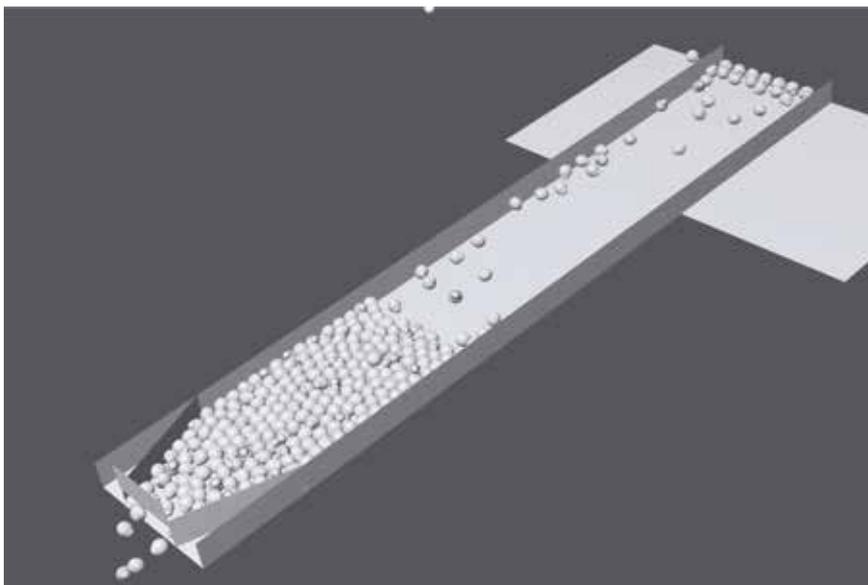


Figure 2. Prediction of berry motion on an inclined surface used opensource simulation software, Blender

Botrytis cinerea – A key industry challenge

The 2019-2020 blueberry seasons have provided significant challenges for industry from the spoilage fungus *Botrytis cinerea* or grey mould. The introduction of early season fruiting varieties combined with favourable climatic conditions over flowering and fruit development have led to above normal incidence of this organism. This has contributed to increased issues with spoilage throughout the supply chain, and reduced shelf life. Together with continual improvements to on-orchard management, harvesting and postharvest handling practises, treatments such as UV or ozone can contribute to mitigation of this disease. UV has been shown to be effective against *Botrytis* in fresh blueberries in the published literature and in lab-based trials completed by our research team.

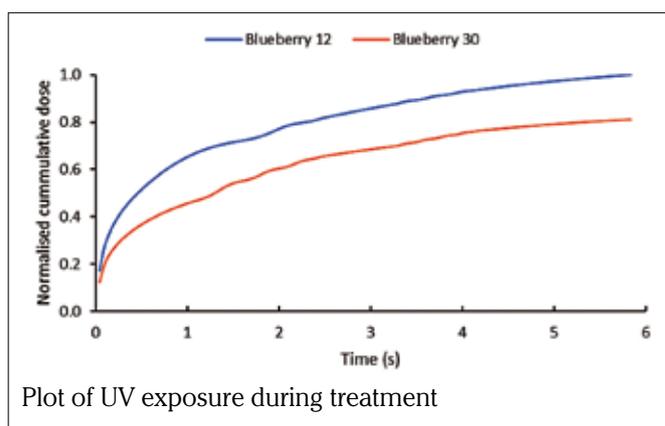
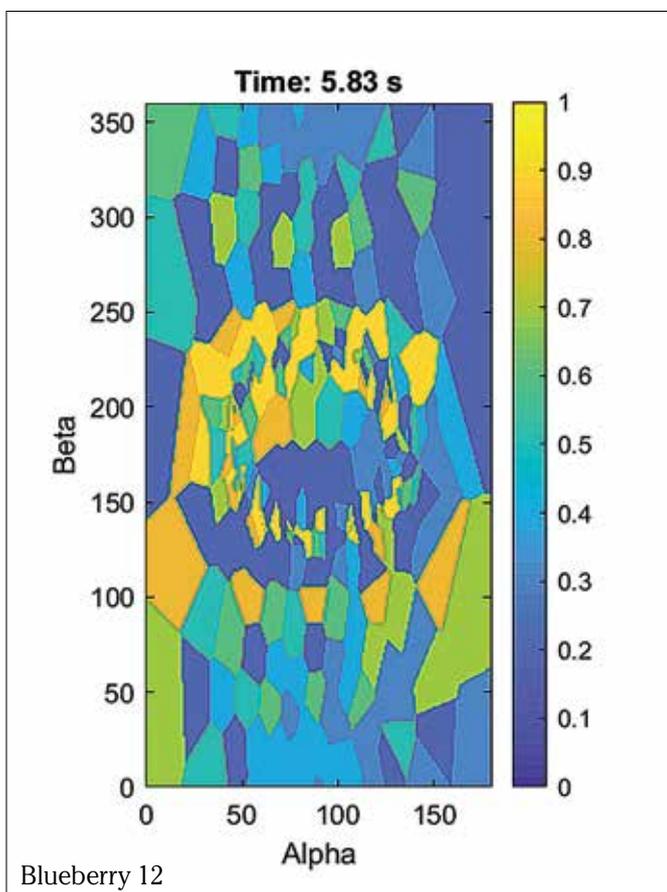
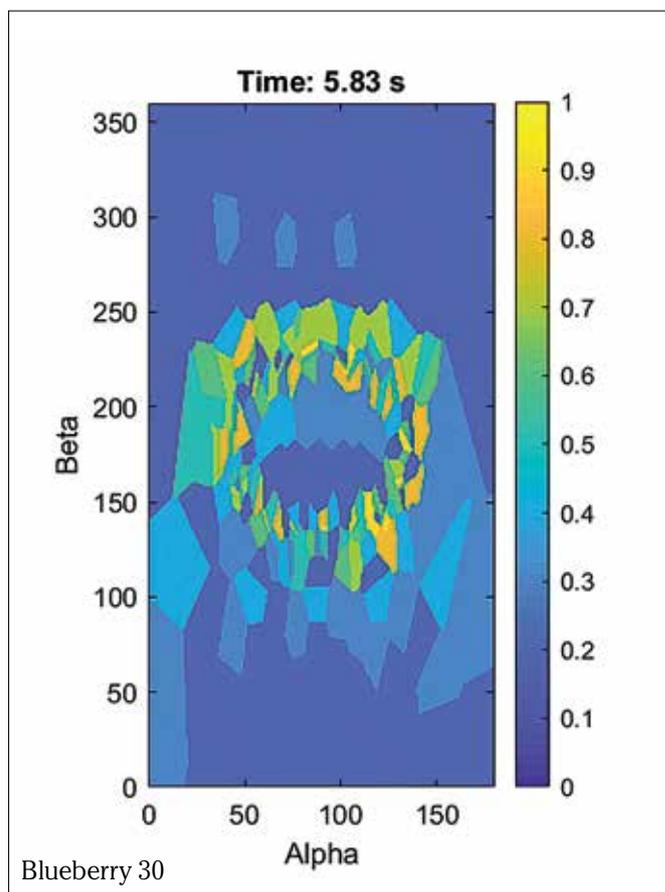
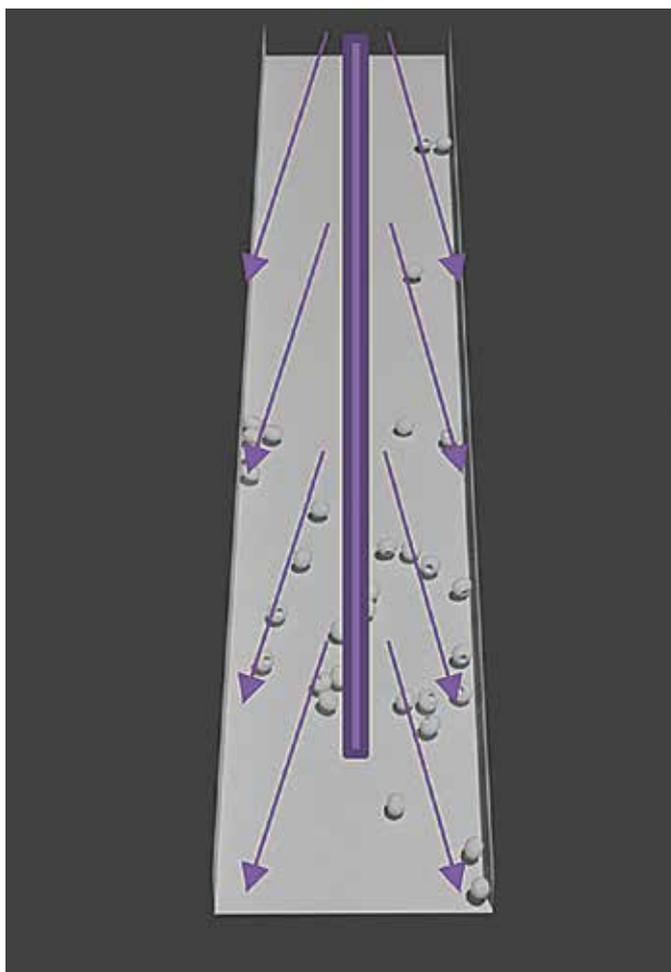
Modelling berry movement and UV exposure

The key to effective UV treatment is exposing the entire fruit surface to light. Mathematical modelling techniques can aid the design of systems to achieve this. Gonzalo, with generous help from Berry Co, has built

a database of 3D scanned fruit from different berry varieties (Figure 1). Early season fruit tend to be larger and flatter, while fruit may be smaller and more spherical later in the season. This variance means that the surface area to be treated and the rolling behaviour, differ throughout the year. A shape library allows mathematical modelling of how the systems can be designed to provide the optimum quantity and homogeneity of exposure (Figure 2).

"Blender", an opensource physics engine, was used to simulate the motion of the berries in each prototype. This software can predict the position and orientation of populations of berries rolling in the system. In this way the effect of berry geometry on movement can be evaluated to ensure we design the process to maximise efficacy for fruit harvested throughout the season.

From the predicted berry history of orientation and position of the fruit relative to the UV source, the UV dose each berry receives can be estimated. Figure 3 shows differences in UV exposure that two different berries receive in the same treatment. By running large numbers of simulations, the average surface treatments can be assessed as part of the design process.



This series of images shows how the “Blender” open source physics engine can simulate the exposure of the berries to UV in prototype irradiation units. Top left shows that berries roll on different tracks in under an axially mounted lamp. Bottom right shows the overall exposure collected by two berries, which took different tracks during a ~6 second exposure. The coloured panels represent 2-D maps of the surfaces of the same two berries showing that some patches accumulate higher exposure than others during ~6 seconds of rolling

Quotes from our industry partners

Shirley Miller, PlantWise consultant, works collaboratively with BerryCo to continually improve the quality of their produce.

“We believe that the professionalism and experience that the Massey team bring to this project will help us to reach our customers with better quality fruit. If this technology improves our reject rates in the packhouse, everybody wins”.

BerryCo’s Technical Manager, Alan McLean

“It is a really worthwhile project focussing on an area of genuine need.”

Michael Egleton, licensee and grower of MBO blueberries, speaking on behalf of Berry Packers Limited.

“At a high level, if this is able to improve our in-market rejections, then I suggest that a discussion with the operational team is appropriate.”

Prototype development

Early rotating prototypes ensured continuous rolling of the fruit and even UV exposure. However, continuous rolling comes at the expense of potential damage and rubbing off the desirable waxy bloom from the fruit surface. As well as consumers seeing bloom as a sign of quality, the waxy layer helps protect the fruit from moisture loss during transport and storage. This potential negative impact, plus the need to integrate more directly into existing grading and packing infrastructure, has led to the development of simpler systems that exploit the movement that berries experience during grading and filling operations. The latest prototype has allowed the testing of different strategies for light source placement and berry exposure on *Botrytis* inactivation and fruit shelf life in a way that translates directly to commercial packing lines.

From a residence time study at the Apata packing facility in Eastern Bay of Plenty an implementation plan and a series of key steps have been developed to demonstrate UV treatment at small commercial scale. We now are in the process of design and manufacture of a final prototype UV treatment system that is integrated with a punnet filling machine provided by Berry Packers BPL. After some preliminary trials on this system at the end of the 2020-21 season, the device will be ready for BPL to carry out their own trials in the new season.

We highly value the open collaboration we have with our industrial partners, BerryCo, BPL, Miro, Bella Berries, PlantWise, Apata and the growers that supply fruit and insights that guide the research. Through these interactions we have begun to build new research programmes in the production, processing and packaging of berry fruit.

Other fruit crops such as cherries and kiwiberries may also benefit from UV treatment and can be tested using the developed technology.

Coming to you soon

Visit FIET at Central Districts Fielddays, Feilding, Manawatu, 18 - 20 March 2021 and FoodTech PackTech, ASB Showgrounds, Auckland, 13 - 15 April 2021.



Food Industry Enabling Technologies (FIET) is funded by the Ministry for Business, Innovation and Employment and its purpose is to support new process developments that have the potential to add significant value to our national economy. The programme has six research partner organisations, Massey University (the host), Riddet Institute, University of Auckland, University of Otago, Plant and Food and AgResearch. Funding is \$16.65m over six years (2015-2021) and targets pre-commercialisation activities. If you are interested in more information, then please contact either Dr Ross Holland (R.Holland1@massey.ac.nz) or Professor Richard Archer, Chief Technologist, (R.H.Archer@massey.ac.nz).

New Zealand Food Safety Update

In this edition, we're focusing on food business registration and our involvement with upcoming conferences and awards.



Do you know your Food Rules?

If you import, grow, manufacture, process, store, transport, or sell food and beverage products, you need to meet food safety requirements, including registering with New Zealand Food Safety or your local council.

Food rules are more flexible than they once were, when they used to focus on the place food was made and facilities provided. These days, commercial food can be made from your own home or a tent in a marketplace – just as long as you have identified, and can manage, any food hazards that might arise. We've also made it easier with a single registration that can cover multiple sites, which provides greater value and flexibility over where you make and sell your food.

If you don't register, New Zealand Food Safety and local councils may take enforcement action (ranging from educational advice, warnings and instant fines, through to harsher penalties including preventing your business operating and prosecution). As well, customers may refuse to accept your goods or use your services if you don't comply with food safety requirements.

If you import food without correct registration, your consignment may get stopped at the border. This means it may not be allowed into New Zealand, it may be delayed, or your foods may be recalled. Either way, this will cost you more.

If you trade in food, you need to register as a food business (with a few exceptions) under either the Food Act 2014, Animal Products Act 1999 or Wine Act 2003. The rules apply if you:

- Import food or beverages for sale (including ingredients).
- Grow crops.

- Process harvested foods (such as grain, herbs or spices, nuts and seeds).
- Manufacture meat, fish, poultry, egg and dairy products.
- Brew, distil or manufacture alcoholic or non-alcoholic beverages.
- Transport or store food (such as providing a food storage and distribution service).
- Prepare, serve or retail food (whether from a shop, a market stall, online and via social media) and/or 'Give' food away to promote your business.

If you need to register, start the registration process right away! The good news is that it's easy to do. **Go to My Food Rules** and complete the online questionnaire to find out what you need to do.

If you are already registered, you can use My Food Rules to check if you are on the right plan or programme for your business – there could be a better option.

Any questions about food rules? Contact New Zealand Food Safety at foodactinfo@mpi.govt.nz or 0800 00 83 33.

Conferences



Join us at the New Zealand Institute of Environmental Health's (NZIEH) Conference, 24-25 March 2021. Sponsored by New Zealand Food Safety, this is NZIEH's first ever virtual conference. Registrations will open in January 2021. A wide range of speakers are lined up for this event, including from Massey University and New Zealand Food Safety. Follow [this link](#) to the conference website to express your interest in this event and receive updates as more programme and event details are released.

New Zealand Food Safety will also be presenting at the **New Zealand Petfood Manufacturers Association Conference**, in Queenstown, 25-26 February 2021. The objectives of the conference are to educate members in compliance matters, and improve productivity, business development and export development. For details about the regulation of petfood manufacturing in New Zealand, [click here](#).

Awards

Entries are open for the **2021 NZ Champions of Cheese Awards**. Hosted by the New Zealand Specialist Cheesemakers Association, and sponsored by New Zealand Food Safety, the Awards close 3 February 2021. Award presentations will be made at the NZ Champions of Cheese Awards Dinner, SkyCity Hamilton on 5 May 2021.

Lipids and Nutraceuticals

A review of the latest news in the realm of natural compounds and health

Laurence Eyres FNZIFST and Mike Eyres B.Sc.

Lipid technology in Covid-19 Vaccines

It has been interesting to read recently about the use of lipid and liposome technologies that we commonly see in the world of nutraceuticals being utilised in the new Pfizer/BioNTech and Moderna mRNA Covid-19 Vaccines.

The technical problem that appears to have been solved is that mRNA is very fragile. Hence the need for keeping these vaccines cold. Charged lipid nanoparticles have been found to be the ideal coating for mRNA as they form a stable coating and facilitate the movement of mRNA particles across cell membranes into the cell cytosol where they are able to use cellular machinery to produce the spike membrane proteins of the corona virus.

For those interested in reading more I recommend having a look at this 2016 review that explains the technology further:

<https://www.nature.com/articles/nrd.2017.243>

The lipids utilised for the nanoparticles in these vaccines are highly specialised and modified. Although the development in this area has been happening for more than a decade, it will be very interesting to watch this space for additional innovations that may arise from this recent technological arms race that has been fueled by billions of dollars.

Do supplements have a place in New Year's weight-loss resolutions?

It's that time of year when people have made their resolutions, are hitting the gym and embarking on their new diets. Weight loss nutraceuticals have been a growing product category over the past few years and it is likely that this will continue in 2021. But the big question, of course, is do any of them work?

An excellent recently published review analysed the available literature with regard to most nutraceuticals currently marketed for weight loss. The authors rate the quality of the evidence by ingredient and also provide the dosages used in trials. They conclude that many of the ingredients covered do have an effect although the effects are often not clinically relevant when the ingredients are used singly. They advocate for further study of combinations of ingredients with synergistic mechanisms of action. For those interested in reading more, the paper is well worth reading:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7551574/>

Big investment for marine lipid research for EXPAX Norway

In December, news of a major investment into research into marine lipids in Norway was announced. EXPAX Norway is set to receive nearly 8 million kroner from the Norwegian Research Council to fund research, in partnership with academic institutions, into 30 naturally occurring marine lipids, including DHA and EPA. Research areas are

to cover cardiovascular, reproductive, ocular, cognitive and skin health and will include clinical trials. The research publications generated by this collaboration will be greatly anticipated and will no doubt help New Zealand's own seafood and marine lipid ingredient industries.

Growth, innovation and awards for NZ functional beverages

Functional healthy beverages continue to be increasingly popular products in New Zealand and around the world, this is especially true amongst millennials who prefer health products as foods or drinks rather than pills and who are also looking for alternatives to conventional high sugar soft-drinks and alcoholic beverages.

Powdered collagen beverages continue to go from strength to strength with established brands receiving capital investment, additional brands being launched, and novel formulations containing herbal extracts as actives hitting market shelves.

Recently a handful of products outside of the collagen/beauty category that either launched or won awards caught these authors' attention.

"Win your day" coffee launched late in 2020 and is an instant coffee that capitalises on the world wide trend of interest in nootropics. Nootropics are actives that support cognition and mental performance and are typically seen in hard-shell capsule formats. "Win your day" coffee contains instant coffee with added plant based adaptogens such as Siberian Ginseng and Lion's Mane mushroom in convenient single serve sachets. You can check out their products here: <https://wydcoffee.com/>

Ārepa, another New Zealand nootropic company with beverage products based on blackcurrant, pine bark and L-theanine from green tea saw expansion in 2020 and is now available in supermarkets. They won the start up category of the NutraIngredients-Asia awards 2020 with their research-based, patented formula. Visit Ārepa at: <https://drinkarepa.com/>

Good Herb Soda make functional beverages based on findings born out of cannabis research, with specific regard to the health benefits of terpenes. Terpenes are components of plant essential oils and are thought to be at least partially responsible for some of the effects of consuming cannabis but are also found in non-cannabis plant sources. Good Herb Soda partnered with True Terpenes, an industry leader in non-cannabis derived terpene ingredients from the USA and won the NZ Inspire+ Artisan Awards in the non-alcoholic craft beverage category. Their beverages are carbonated with no added sugar (only 10 calories per bottle) and are pleasantly fruit flavoured. Check out good herb soda at: <https://goodherbsoda.com/>

It is great to see that the years of work that have gone into fostering an environment of innovation and support for New Zealand start-ups with organisations like Callaghan Innovation and the New Zealand Food Innovation Network is coming to fruition. We expect to see further growth and innovation in this exciting area.



Ārepa is a New Zealand nootropic company marketing beverage products based on blackcurrant, pine bark and L-theanine from green tea

Nutrition B2B platform launch

The rise and growth of personalised nutrition brands and products has been astounding over the past few years. The growth is based on advances in the science of nutrigenetics and nutrigenomics and has been propelled by technological advances in functional testing and “wearables” that track and measure health in real time. Qina is a company that has recently launched a digital platform for B2B-based companies operating in the personalised nutrition space and aims to link companies such as ingredient suppliers, biotech firms, and health practitioners. Companies can subscribe to the service and search for companies, products and research to find suitable matches for collaboration and to stay abreast of industry trends. Check out the platform here: <https://www.qina.tech/>

Mike Eyres, BSc. BNatMed

Mike Eyres is a technical consultant, researcher and Registered Medical Herbalist and Naturopath (NZAMH) with 18 years professional experience in the food, beverage, and natural health industries. He was a co-author of a peer reviewed, scientific article in the journal “Nutrition Reviews” on coconut oil and cardiovascular risk factors. Consulting projects have covered herbal, food and nutraceutical products in various formats including gel caps, soft gels, sachets, bulk powders, tablets, and topicals. mike.eyres@gmail.com



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3. Verification

NZ Food Safety and Allergy NZ

New Zealand Food Safety's Food Compliance Services is working closely with Allergy NZ to help people with food allergies keep safe.

For many New Zealanders, undeclared allergens in food are a matter of life and death. The prevalence of food allergies is increasing, with more children and adults having an allergy to one or more foods.

Allergy New Zealand, a national organisation that provides information and support to those living with allergies, estimates that up to 5% of the population have some type of food allergy. The reasons for the increase in prevalence are unknown.

Allergy NZ's allergy advisor, Penny Jorgensen says, "Even a trace amount accidentally ingested could cause someone to have a reaction".

Reactions range from mild to severe and usually happen within minutes. A severe reaction, known as anaphylaxis, affects the breathing and/or cardiovascular system and is regarded as life-threatening.

Managing a food allergy requires strict avoidance of the food concerned, and those affected need to take precautions and care when purchasing and preparing food.

"This is why accurate allergen labelling on food products is so important for food-allergic consumers," says Ms Jorgensen.

New Zealand law requires packaged food labels to warn consumers if any of the specified allergens* are present in food. Sellers of unlabelled food such as takeaways, cafés etc are required to provide this information to consumers on request.

Under the Food Act 2014, it is the responsibility of all food businesses, including importers, retailers, manufacturers, cafes and restaurants to know what is in their food in order to meet the compositional and labelling requirements of the Australia New Zealand Food Standards Code. For food allergens, this doesn't just involve keeping track of all ingredients throughout the production process, but also managing the risk of cross contamination with other ingredients.

"This can happen anywhere in the production process, literally from paddock to plate," says Ms Jorgensen.

One of the biggest risks to food-allergic consumers is where an allergen is present but not declared on the label in food they have purchased. Incorrect allergen labelling is a major cause of food recalls in New Zealand.

New Zealand Food Safety's National Manager for Food Compliance Services, Melinda Sando and her team are responsible for investigating potential food safety concerns, including any reports of undeclared allergens in food, to help protect consumers.

"We want consumers to report if they suspect their food has undeclared allergens," says Ms Sando. "Our team receives information about undeclared allergens from a number of sources, including consumers, verifiers and directly from food businesses.

"Verifiers and food businesses are legally required to report all critical non-compliances such as undeclared allergens on labels to the appropriate registration authority (either their local council or New Zealand Food Safety, part of the Ministry for Primary Industries).

"Once a report is received, an investigation is carried out to determine what action is required including product recall and/or relabelling.

"Consumer complaints often come through Allergy NZ, which are then sent to the Food Compliance Services team," says Ms Sando.

Ms Jorgensen adds, "Through our close working relationship, we learn a lot from the investigations undertaken, and it certainly helps to work together on advising both consumers and food industry on allergen risk management as well as labelling".



Melinda Sando, NZ Food Safety National Manager for Food Compliance Services, left, with Penny Jorgensen, Allergy NZ's allergy advisor

Food Compliance Services and Allergy NZ actively encourage anyone who has an allergic reaction to purchased food that they think contains an undeclared allergen, to report it directly to New Zealand Food Safety. By reporting these incidents, they can help prevent this happening to other people.

The Food Compliance Services team follows up reports with the food business involved and sometimes a recall of that food may be needed. A food recall involves informing consumers about the risk and ensuring the food is not available to consumers until it is safe. Food recalls can also occur after investigations of reported foodborne illness, or complaints about the safety or suitability of food.

If there is a food recall that includes an undeclared allergen, this information is communicated to the public and shared with Allergy NZ so they can reach their members.

Food Compliance Services and Allergy NZ have recently produced a pamphlet for consumers on when and how to report a product with a potentially undeclared allergen; and on encouraging food-allergic consumers to subscribe to MPI's food allergen recall notification service. Subscribers are emailed directly the information they need to know about food recalls for undeclared allergens*.

Subscribe to our food recalls page and receive automatic notifications of food allergen recalls. A full list of food recalls is located here.

* To report an allergic reaction you or your family have experienced, due to undeclared allergens in food, call 0800 00 83 33 or email info@mpi.govt.nz.

If you need help or advice on allergen labelling on food products, contact Allergy NZ on allergy@allergy.org.nz or 0800 34 0800.

*Allergens in food: peanuts, tree nuts, milk, eggs, sesame seeds, fish, shellfish (crustacea and molluscs), soy, lupin and cereals (gluten) and sulphites.

Allergy New Zealand - advocating for consumers

Penny Jorgensen, Allergy NZ's allergy advisor



Allergy New Zealand works to help keep food-allergic consumers safe.

Allergy New Zealand was first established in 1981, to support those living with allergies. At that time, food allergy was considered a rare disorder. Since then, food allergy has escalated in prevalence and has become a common global problem. Overall population estimates are that it affects approximately 2.5 – 3% of the general population.¹ However, prevalence data around the world varies widely, ranging from 1% to 10%. An Australian study in 2009 found one in ten (10%) infants had a food allergy by 12 months of age.² The Growing Up in NZ study also found one in ten children at age two years had a doctor-diagnosed allergy, mainly to egg, dairy and peanuts.³

At the same time, there has been a significant increase in rates of anaphylaxis to food. Anaphylaxis is a severe reaction which can be fatal. NZ studies found a near two-fold increase in hospital admissions for food-triggered anaphylaxis in the 10 years from 2002- 2011 in adults,⁴ and near three-fold in children in the ten years from 2006 – 2015.⁵ Highest rates were in the Pacific and Asian populations.

The result of this growing epidemic is an increased demand for medical services, and significant economic cost and reduced quality of life for those living with food allergies, including children and their whanau. It is therefore now a serious public health issue that requires action by all levels of government and the community.

Avoidance of food allergens is the only way to manage food allergies, along with being prepared for an emergency response in case of anaphylaxis. People with food allergies are therefore dependent on accurate allergen labelling (or information being provided) on food for sale, for their own or their child's safety.

Allergy New Zealand works in partnership with a wide range of stakeholder organisations, both nationally and internationally, to provide information and support, and to address the many issues our food allergy population faces. These include clinical and research bodies, food industry associations, regulators, and patient organisations.

We have been members of the Australia-New Zealand Allergen Collaboration since it was established in 2011 by Food Standards Australia NZ (FSANZ). Members of the collaboration work together on non-regulatory ways to support consumers with food allergy. An "Allergen Portal" has been set up on the FSANZ website, with resources for the food industry, as well as consumers, clinicians and regulators: Allergy information for food manufacturers, retailers and importers (foodstandards.govt.nz)

Mandatory food allergen labelling was introduced in New Zealand in 2002, which made a huge difference to consumers with food allergies at the time. However, a range of frustrations have emerged. Some of these should be resolved with the 'PEAL' (Plain English Allergen Labelling)

update to the Food Code, (anticipated to be gazetted in February 2021). The 2014 Food Act also resulted in a regulatory framework in NZ which requires food businesses to risk-manage food allergens, which has helped make food allergen declarations on labels more accurate.

We appreciate this may require food manufacturers to change an allergen declaration, or could be needed because of a recipe reformulation, variation in ingredient supply, or a change to the production process, line or facility.

However, an issue that arises from this is where there is a change in a product's allergen declaration on the ingredients list, but no change in the branding or front of pack to alert the consumer. While we strongly recommend food allergy consumers 'read every label every time', it needs to be appreciated that this is a time-consuming exercise; and challenging for busy households to manage every time they go to a supermarket. It also takes time for consumers to learn to trust that a particular product is safe for them or their child: once they do, they may not regularly check the label, and may also recommend it to others.

We therefore ask food manufacturers, where a new allergen is added to a label declaration, to consider how to alert customers to the change. The Allergen Bureau's 'Food Industry Guide to Allergen Management and Labelling' includes recommendations on this.

Allergy New Zealand provides an Allergen Alert notification service to its members and e-newsletter subscribers, for food manufacturers to alert New Zealand consumers, whether to changes in allergen declarations, or food recalls due to undeclared allergens. Please contact us (details as below) if you would like to use this service.

www.allergy.org.nz

allergy@allergy.org.nz

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The Allergen Bureau – new insights on informing the food industry

When an Australia New Zealand collaboration of cross-sector stakeholders involved in food allergen management – to be facilitated by Food Standards Australia New Zealand (FSANZ) – was established 10 years ago, the Allergen Bureau was honoured to be involved as a founding member.

The Australia New Zealand Food Allergen Collaboration was formed to strengthen engagement and collaboration among a range of stakeholders and provide a means of sharing information and developing common approaches to enhance the effectiveness of risk management of food allergens – with the objective of supporting consumers to make safer food choices. Given the stated purpose for this new Allergen Collaboration was so strongly aligned with the overall objective of the Allergen Bureau, support for the Allergen Collaboration from the peak industry body representing food industry allergen management in Australia and New Zealand was assured.

The next 5-10 years promises to be an exciting and productive time for the Allergen Bureau. While our mantra of informing the food industry remains the same, the recent development of our Strategic Plan 2021-2025 sees the Allergen Bureau formally expanding its focus from that of a peak ANZ industry body to a globally representative food industry organisation. This is articulated in our new vision and mission.

- Vision: A trusted food supply for allergen sensitive consumers around the world
- Mission: Lead the global food industry in best practice allergen management, sharing information that builds trust and transparency that supports allergen sensitive consumers to make informed choices

So, what is the Allergen Bureau doing that is new? Anticipating our drive to lead the global food industry in best practice allergen management, the Allergen Bureau has recently embarked on a refresh of our trusted brand, with a new, consistent look and feel across all marketing and social media assets. The Allergen Bureau is now on social media across all the key platforms to ensure we are easy to find and can update and engage with our followers with the latest food allergen news and information from around the globe.

Two exciting developments for the Allergen Bureau in the coming months will be the launch of a new Allergen Bureau website and a new website platform for VITAL[®] Online. This will see our two most important digital platforms greatly improved in terms of usability and mobile friendly for easy access to information 'on the go'.

The Allergen Bureau website is our key resource for making available essential industry guidance – such as the Food Industry Guide to Allergen Management and Labelling for Australia and New Zealand, the Allergen Bureau's Allergen Risk Review website and the Food Industry Guide to the Voluntary Incidental Trace Allergen Labelling (VITAL[®]) Program: industry news and events, food allergen FAQs, our conference presentations, and access to our free helpline services. Our new website will make it even easier for us to communicate with and inform the food industry.

The internationally recognised and used VITAL Program is a standardised allergen risk assessment process for food industry and is the centrepiece of Allergen Bureau resources. VITAL Online is the user-friendly, web-based VITAL Calculator and was first developed and released in 2015 to assist with and record the implementation of the VITAL Program for food products. Responding to advances in web-based technology, the Allergen Bureau has embarked on a rebuild of the VITAL Online application to improve performance, manageability, and reliability of the platform. Our VITAL Online service will continue to provide the global food industry with a valuable format to store the allergen status of ingredients and processing profiles and to record the assumptions used for the VITAL risk assessment over the next 5 years and beyond.

Event updates will be a key part of our ongoing communication strategy, and we are thrilled with the abundance of great events in the 2021 calendar. The Food Allergen Management Symposium (FAMS 2021), scheduled for May this year, is the premier Southern Hemisphere symposium dedicated to assembling the world's best minds across the spectrum of food allergen management. FAMS always provides a holistic symposium programme covering the latest issues in food allergen management and is targeted at everyone working in the food allergen space.

Hot off the Allergen Bureau press is the 2021 Unexpected Allergens in Food guidance document. This guide provides a list of foods, ingredients and raw materials that may unexpectedly contain allergens. It also provides food business operators (FBOs) with questions that they can ask their suppliers to support their allergen risk review process. This revised and updated 2021 version of the 2011 Unexpected Allergens in Food contains an expanded and updated list of foods, as well as new information about agricultural co-mingling, and food fraud. A new inclusion are case studies that show the complexity in the supply chain, where allergens may be unexpectedly incorporated as a result of agricultural co-mingling.

The Allergen Bureau will be updating all our relevant guidance resources to reflect the requirement for mandatory food allergen declarations to address the anticipated early 2021 gazettal of FSANZ P1044 Plain English Allergen Labelling (PEAL). Our updated industry guidance will look to assist food industry on the implementation of PEAL across the upcoming five-year implementation timeframe.

We are confident that our extensive suite of new resources and improved digital platforms will greatly assist all Allergen Collaboration members ongoing.

The Allergen Bureau is delighted to have been a part of the Allergen Collaboration since its inception and we look forward to continuing to work with our collaborative colleagues on new and emerging issues in food allergen management.

For more information visit allergensbureau.net or email us on info@allergensbureau.net

Better microbes for fermented foods

Accelerated Evolution: A step-change in food fermentation

Altermann^{1,2}, Ryan M. Chanyi^{1,2} and Li Day¹

¹AgResearch, Palmerston North 4442, New Zealand ²Riddet Institute, Massey University, Palmerston North

Fermented Foods

Fermented Foods are among the oldest cultural and agricultural achievements of human civilisation. This ancient method for preserving fresh fruits, vegetables, milk, meat, and fish is today recognised as a natural process to achieve unique flavour and texture properties, enhance nutritional values and deliver probiotics through food products to support human health.

Traditionally, fermented foods have been manufactured by the producer or harvester directly, in small-scale and with location-specific microbial consortia that have co-evolved with regional practices, environment, continuous back-slopping or spontaneous fermentation. This has led to great diversification, allowing fermented foods to define regions and make them recognisable across the world such as Kefir, Swiss Cheese, Greek yoghurt, Crème fraiche, Kimchi, Sauerkraut, Natto, or Kvass. Each was originally associated with a specific geography and population and now has many local variations. Concomitant with the wide range of raw materials and practices has come the risk of fermentation failure. For instance, introduction of spoilage microbes, bacterial infection by phage viruses, variable product quality due to genetic drifts in the microbial consortia, or uncontrolled changes in the production environment.

Large scale fermented food production – its current limitations

Expansion of fermentation processes from artisanal to industrial was necessary to meet increasing consumer demand for fermented foods with unique sensory properties and health benefits. Modern large-scale microbial fermentation can range from 20,000 to 2,000,000 L (Crater and Lievense, 2018) and represents considerable investment in materials and risk of severe financial impact if fermentation fails. Risk is mitigated by using highly characterised and standardised starter cultures that ensure fermentation reliability and product consistency. These are provided by only a few global manufacturers including DuPont, CSK (Cooperative Rennet and Colour Factory), Chr. Hansen, and DSM Food Specialities. For the New Zealand dairy sector, Fonterra Co-Operative Group maintains a strong monopoly on starter cultures. Commercial cultures are a reliable resource for the industry. However, for historical reasons, many of the strains feature similar properties for fermentation, rheology and flavour development, and as a consequence the range

of distinguishable products has steadily reduced. It has been difficult to source alternative microbes to facilitate large scale production of tailored or specialised fermentations. This limits manufacturers' ability to innovate with products that appeal to new target-markets or the needs and preferences of specific consumer groups.

Starter strains are part of the solution

Producers are being challenged to make foods that are 'natural' and 'healthy', minimally processed, and contain fewer preservatives and additives, whilst delivering novel flavours and textures (Manzano et al., 2020). One way to achieve these properties in fermented foods is by using a new generation of microbial starter strains. This trend has been recognised internationally and companies such as Chr. Hansen have begun offering variants of familiar food-safe strains that exhibit desirable new characteristics. One recent example is their SWEETY® culture (<https://www.chr-hansen.com/en/food-cultures-and-enzymes/fresh-dairy/cards/product-cards/sweety>). It hydrolyses lactose (milk sugar) into galactose and glucose in the same way as traditional dairy starters, but then preferentially feeds on the galactose. Thus, during fermentation glucose begins to accumulate, resulting in sweet tasting yoghurt without added sweeteners. Starter strain development is a complex task and is usually in the hands of the big international suppliers. Local manufacturers of fermented foods who want to introduce hallmark flavours and textures would benefit from a more accessible and responsive means to create their premium products. This is the aim of a New Zealand government-sponsored MBIE Endeavour Research Programme called 'Accelerated Evolution: A step-change in food fermentation'. Its ambition is to introduce and maintain a new capability for the food sector. Our researchers and industry partners are interested in how food-grade starter microbes can be coaxed to generate novel taste compounds, be biological substitutes for chemical additives, acidify better, and provide stronger innate defence against pathogens.

The world is not yet ready for GMO

An easy way to change the behaviour of starter bacteria would be to manipulate its metabolic processes by removing, adding or altering key genetic elements. However, much of the world is not yet ready for widespread use and consumption of these modified organisms (GMOs)

Table 1: Classes and examples of DNA damage that can cause mutation. Methods currently used by our research programme are circled.

Classes of DNA mutation						
	Physical	DNA reactivity	Intercalating chemicals	Metals	Base substitution	Biological agents
Examples	Ionizing radiation (x-rays)	Reactive oxygen (H₂O₂, superoxide)	Ethidium bromide	Arsenic	Base analogues	Transposons
Mode of action	DNA breakage and other direct damage	Production of base adducts, DNA strand breaks and crosslinks	Frameshift mutation during replication	Production of reactive oxygen	Replaces a DNA base (A,T,C,G) during replication	Gene disruption
Examples	Radioactivity	Alkylating agents	Proflavine	Nickel		Phage viruses
Mode of action	Induces DNA breaks and generates reactive oxygen	DNA crosslinking and breakages	Frameshift mutation during replication	DNA hypermethylation		Gene disruption, Horizontal gene transfer
Examples	UV light	Psoralen	Daunorubicin	Cadmium		
Mode of action	Produces pyrimidine dimers, causing errors in DNA replication	Combined with ultraviolet light causes DNA cross-linking and hence chromosome breakage	Blocks transcription and replication	Affects DNA repair processes		

in food products. Fortunately, there are other options. Microbes do not have sophisticated DNA repair mechanisms and are subject to faster genetic drift than higher organisms. Errors in their DNA replication machinery or exposure to environmental factors that damage DNA result in the accumulation of changes in their genetic makeup. Most of these changes are silent, some have detrimental effects and are quickly lost from the population, and a small minority will provide a competitive advantage for the current environment. This natural phenomenon, called random mutagenesis, is the engine of evolution. It was exploited for the development of the Sweetie® culture. It is less targeted and controlled than GMO techniques, but is currently the only method approved in New Zealand for making new food-grade starter microbes. The challenge with randomness is overcoming the needle-in-a-haystack odds of any genetic change being desirable. In any standard fermentation, random mutagenesis occurs with a mutation likelihood of $\sim 1e^{-9}$ per nucleotide (Wang et al., 2017). Combined with an average genome size of $\sim 2,000,000$ base pairs, which encode $\sim 2,000$ genes, roughly one in 500 microbial cells will feature a random change in their genome. Under the assumption that any single sequence change in the gene relevant for a new property mediates the desired change, one in a million cells will harbour a desired modification. Therefore, only 1 in a million bacteria will have a genetic change in the gene of interest, with a vast majority of those changes being silent or detrimental. If the new property will require complex changes where multiple genes are involved or entire biochemical pathways are redirected, the likelihood for such an event decreases even more. Therefore, for this to be a successful approach to be exploited to enhance the functional traits of fermentation strains, much time and effort are required, and methods to accelerate this process are needed.

Accelerated evolution towards new phenotypes

We are developing techniques to increase the rate of mutagenesis and rapidly identify desirable phenotypes, which are the physical and metabolic expressions of an organism's genes. Through consultation with the New Zealand Ministry of Primary Industry (MPI) and Environment Protection Authority (EPA), we are ensuring that the results are fully compliant with current regulations and do not result in the creation of GMOs. Mutation can be increased by exposing cells to various stressors that directly or indirectly damage DNA (see Table 1). Legislation restricts what methods can be used with food, and some agents cannot be experimentally applied even though they are common in the field. These include bacteriophage (viruses that exclusively infect bacteria) that are the most abundant biological entity on earth, normal mediators of microbial change, and a major concern in industrial scale yoghurt production. Such are the quirks of laws that they do not always reflect the nuance of nature. From the remaining classes of stressors, UltraViolet light and the chemical psoralen were chosen as the preferred agents for our research because of their accepted presence (sun light) and plant-based origin. UV light and UV augmented with psoralen create different types of genetic changes in bacteria (Figure 1). Exposure to UV causes localised damage to pyrimidine bases in the DNA sequence through the creation of cyclobutane dimers that typically results in conversion of cytosine to thymine. This type of modification is preferable for affecting gene expression or the activity and specificity of enzymes. When UV light is combined with psoralen, covalent inter-strand crosslinks are formed that prevent transcription and replication machinery from processing the genetic region. Repair mechanisms are

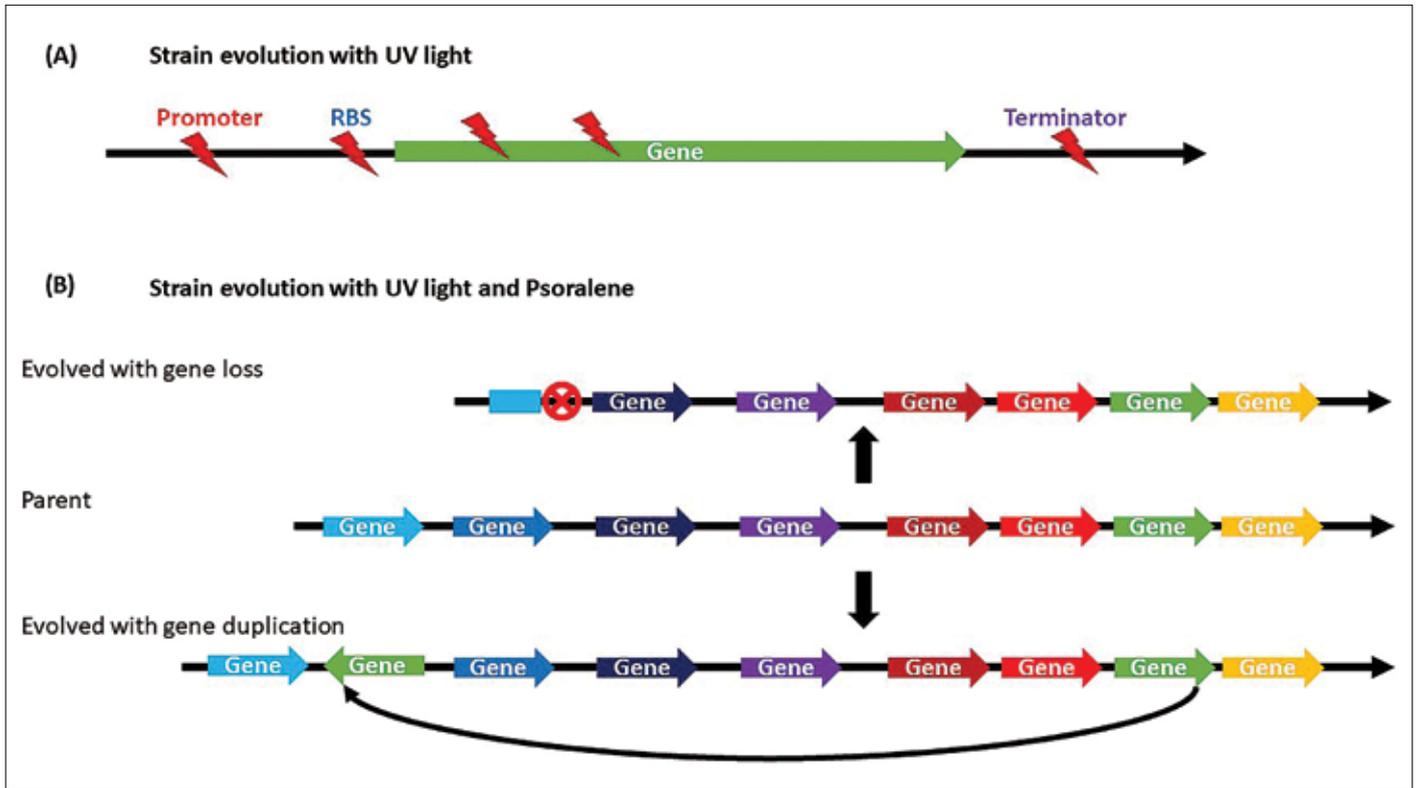


Figure 1: Types of DNA changes seen in natural and accelerated evolution. (A) Exposure of DNA to only UV light causes point mutations (indicated in red) that can affect gene regulation (gene promoter, ribosomal binding site or terminator) or the gene itself by altering the translated amino acid sequence. (B) Exposure of DNA to UV light and psoralen can create larger chromosomal rearrangements leading to loss of genes and their functions, gene duplication and other structural changes. Such larger changes can affect the broader metabolic network within a cell, closing down some pathways while opening up others

employed to cut away the covalent linkages, which can result in large fragments of DNA being completely removed. These modifications are preferable to significantly alter a bacterium’s metabolic capacity, for example, removing the ability to process a specific compound. Each microbe has different tolerances towards exposure to UV light and psoralen. The optimal level of exposure, where the population accumulates a useful amount and variety of mutations without being impaired in overall fitness is a critical first step for accelerating bacteria evolution. Too little exposure and it becomes improbable to find strains with altered phenotype properties, while too much exposure causes too much damage in the genetic makeup.

Once a microbial population in, say, a petri dish, has been exposed to DNA mutagenesis, individual cells of this population need to be isolated, grown up, and preserved for future evaluation of properties. There is no way to know which cells in the dish have been affected, so many thousands may need to be ‘picked’. This labour-intensive task is made possible through robotics. Our high-capacity bacteria handler can identify, pick and redistribute thousands of microbe colonies per day. These are stored in barcoded 96-well plates and form a library of strains, ready to be mined for valuable characteristics. The bottleneck for developing new starter cultures by random mutagenesis is measuring phenotypes. High-throughput assays must be designed

that can efficiently screen for any desired property. A key instrument for such screening is the Omnilog® Phenotype MicroArray System, which quantifies bacterial metabolism (i.e. energy production and consumption) via a tetrazolium dye colorimetric reaction. The Omnilog® can measure up to 4800 individual strains, recording data for each one every 15 minutes. Responses by evolved bacteria to more than 1,900 different physiological conditions can be evaluated, and this provides insight into if and how their metabolism has been changed. One large and fundamental category of tests involves identifying what carbon sources (e.g. sugars) the bacteria can consume. The full metabolic profiles of evolved strains are always compared back to their original food-safe parent. This ensures that they do not exhibit any unwanted properties that would render them unsuitable for fermentation in a commercial setting. Candidate strains identified as having a positive change in the selected characteristic are subjected again to random mutagenesis and screened for modulations in their metabolic profile. This iterative process holds the promise of stepwise creation of stronger changes in the strain until a threshold is reached upon which no further improvements can be achieved. Finally, the best-bet strains are genome-sequenced and compared to the genetic blueprint of their parent. All changes in the genome can thereby be documented, a critical step in demonstrating continued food safety

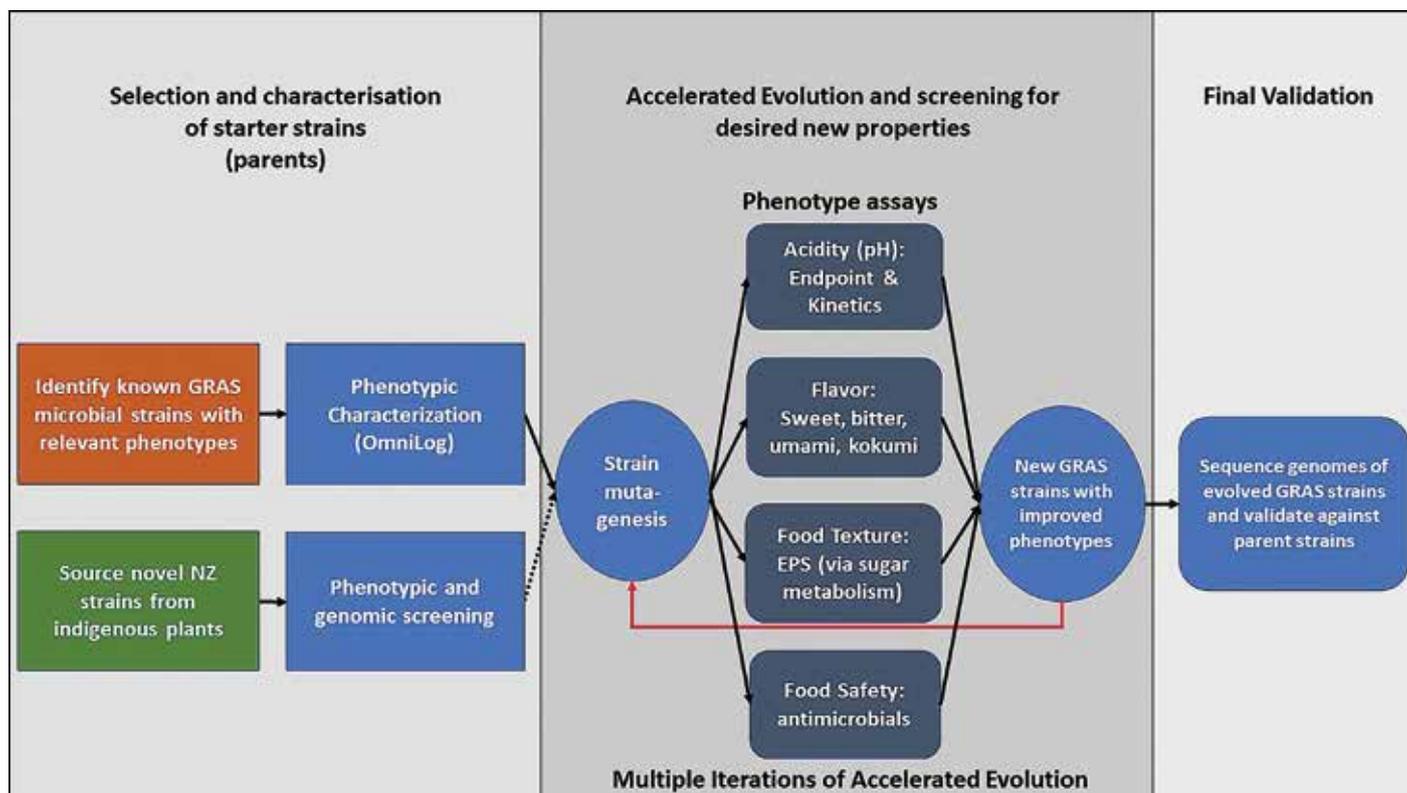


Figure 2: Schematic of the accelerated evolution workflow. Parent strains can be familiar starter strains already in use or novel strains isolated from within New Zealand that have the potential to confer New Zealand-specific flavour and texture properties

and fitness for purpose. The successful strain with the least amount of genome change is then ready for commercial manufacture of novel fermented foods.

A schematic of the entire method is shown in Figure 2.

Example: Accelerated evolution with *Lactobacillus rhamnosus* GG

As a proof of principle, the bacterium *Lactobacillus rhamnosus* GG underwent the UV/psoralen Accelerated Evolution workflow. This microbe is not a food fermenter particularly, but it has been extensively studied as a dietary probiotic.

- The first aim was to demonstrate that our methods do not alter a key feature of food-grade cultures, which is having a low level of antibiotic resistance as outlined by the European Food Safety Authority (EFSA). That is because no one wants resistance genes to become widely distributed in the environment.
- The second aim was to show that when this strain was evolved, the genome changes are unlikely to affect its safe use. We intend to present the results to New Zealand and Australian regulatory authorities, and they will rule on whether a strain created this way is a 'new organism' and subject to strict oversight or merely a biological off-shoot of its parent. The distinction is crucial, as new organisms are unlikely to be approved for food.

To determine whether *Lb. rhamnosus* GG would develop an increased level of resistance towards a range of antibiotics and related compounds, the Omnilog® system was implemented with 192 potentially inhibitory compounds at 4 different concentrations. The parent *L. rhamnosus* GG and an evolved strain designated *L. rhamnosus* GG-evolved were

evaluated. We observed no gain in resistance against any of the globally significant antibiotics and antimicrobial compounds, with the exception of trimethoprim, to which the evolved strain showed a slight increase in tolerance (Figure 3). Trimethoprim is used mainly in the treatment of bladder infections and is not part of the EFSA antibiotic testing panel for food processing. The increase in tolerance of the evolved GG strain would therefore not jeopardise its use as a fermentation starter culture. On the contrary, *L. rhamnosus* GG-evolved was *less* tolerant to the antibiotic cefuroxime and other medical compounds chloro-2,4-dinitrobenzene, trifluoperazine and procaine (Figure 3). The results demonstrate that this evolved strain has retained its safe status pertaining to antibiotic resistance and can be further investigated towards changes in other properties relevant to food fermentation such as pH kinetics and carbohydrate utilisation.

Summary and outlook

Accelerated Evolution is a transformational development for New Zealand. As a new capability for the food sector it will facilitate growth and innovation around fermented products. Manufacturers that invest in modifying the metabolic profiles of their established starter cultures will be better able to satisfy new demands of local consumers and the expectations of global markets. This MBIE research programme has developed a range of medium- and high-throughput assays for useful phenotypes in food-safe bacteria. Thus far these include pH kinetics and endpoints, carbohydrate utilisation, fermentation temperature optimisation, lipolysis and proteolysis that influence flavour profiles, and production of exopolysaccharides that mediate texture. Parallel projects co-sponsored by industry partners are already leveraging the results to create the tailor-made solutions for NZ industries.

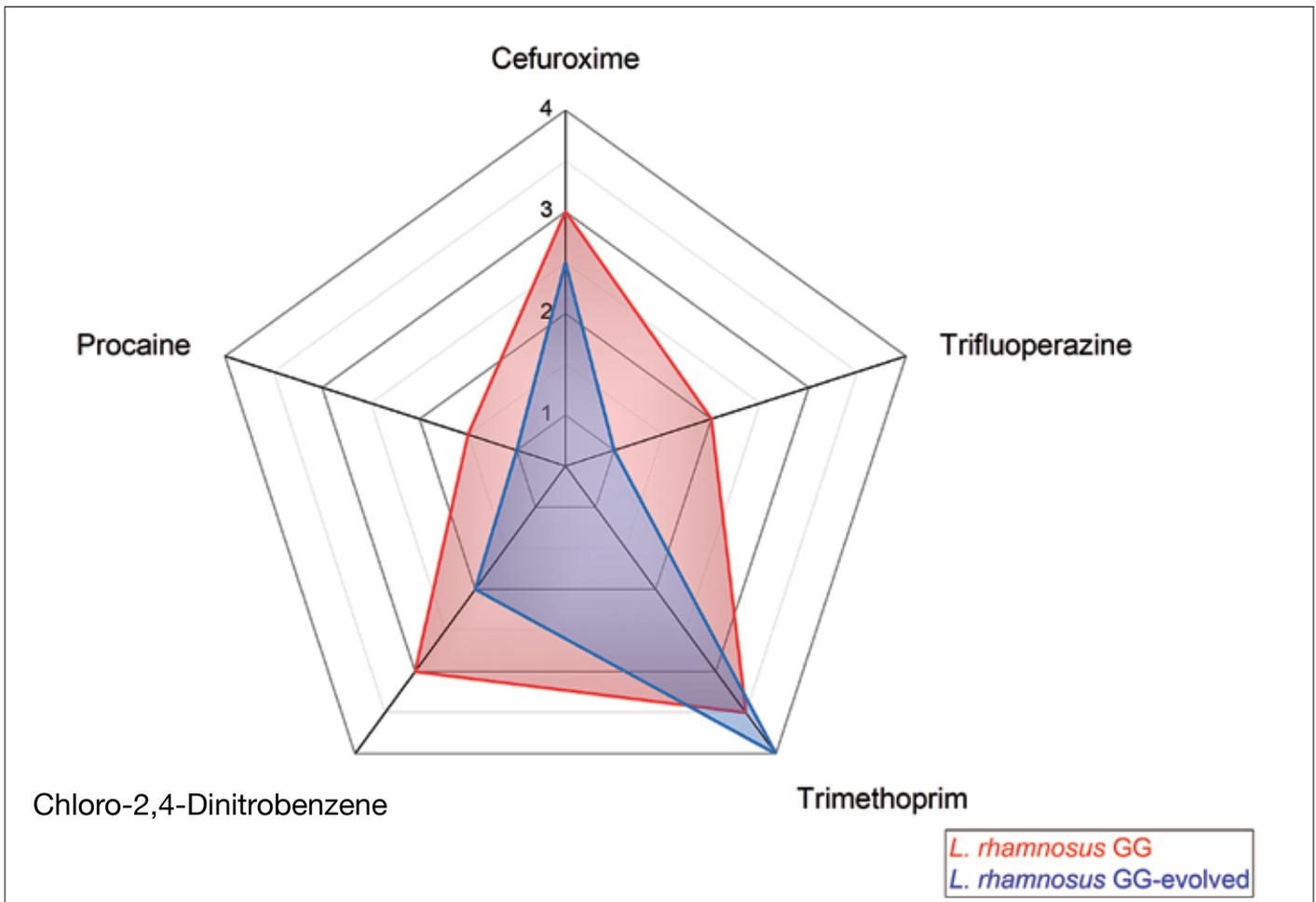


Figure 3: Radial plot depicting the susceptibility of *Lactobacillus rhamnosus* GG (red) and *Lactobacillus rhamnosus* GG-evolved (blue) against a five exemplars of antibiotics and related compounds. The scale indicates the relation between increasing concentrations of compounds and the degree of resistance. Larger values imply a greater level of tolerance at higher concentrations.

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Acknowledgments

This work was supported by an Endeavour Research Programme grant entitled "Accelerated Evolution: A step change in food fermentation" (C10X1707) from the Ministry of Business Innovation & Employment, New Zealand. We thank Scott Knowles for his critical review of this article.

Promoting Food Technology Careers

NZIFST members support students at Carmel College

Despite a very disrupted school year, seventeen Year 12 students from Carmel College have achieved Team Silver Challenge CREST for developing new food products.

The five teams were supported by teacher Sandy Goonan and mentored by Sarah Leakey and Mitchell Thompson from Sensient Technologies, Elise Waddell from Hawkins Watts, and EeLaine Yeoh, Rebecca Lock, Jane Dunn and Shirin Haydarzadeh from Tip Top.

Each team developed a novel product to meet the brief set by their mentoring company. Their finished products were a range of botanical iced teas, shareable, dairy-free frozen desserts: “ice cream” sandwiches and Kiwiana-inspired sorbet bites, South American-inspired dessert sauces, and organic, fruit-and vegetable flavoured energy drinks.

In November, the teams presented their projects and products at a CREST showcase held at the school. Among those attending were their mentors, and four fourth year food technology students from Massey University. Two of the Massey students had “been there, done that”, doing Team Silver Challenge CREST projects when they were at school. One, Valencia Ngadi, was a past pupil of Carmel, so a great role model for the girls.

NZIFST members mentor NCEA L3 students

The food industry also supported three of Sandy’s Year 13 students. Margie Hunt, Jessica Chong (Delmaine) and Emily Barry (Griffins) each mentored a Year 13 student, who did an individual product development project for NCEA L3 food technology. The students developed Kiwiana-inspired dessert sauces, no allergen, high protein bliss bites and high protein, low sugar cookie bites.

Congratulations to Sandy and her students for persevering under such difficult circumstances, and a sincere thank you to the mentors and their employers for supporting the school.



Mitchell Thompson and Elise Waddell tasting the energy drinks at the Team Silver Challenge CREST showcase



Emily Barry, from Griffins, working with Charlotte Bedford on her product development project for NCEA L3 food technology



Eileen Han, from Matura Valley Milk, right, was a member of the panel in Matura

GrowingNZ Teachers' Days Out



Introducing teachers to careers in our industry

In November/December, NZIFST was invited to participate in a series of Teachers' Days Out organised by GrowingNZ. Teachers toured several local businesses involved in the food and fibre sectors, and heard from young professionals working in those sectors.

The Day Out was an interactive professional development day for teachers to connect with and gain knowledge and understanding of the food and fibre sectors. The purpose was to raise awareness and positive perceptions about career opportunities and pathways and enable teachers to confidently support students to pursue training or tertiary studies and careers in those sectors. The events were attended by Agribusiness, Ag/Hort and STEM teachers, careers advisors and transition educators.

NZIFST members spread the word

Four young professionals from the food processing industry joined other young professionals working in the food and fibre sectors, to share their stories and experiences of work. Amanda Thompson from Fonterra Palmerston North spoke at the Feilding event; Ngan Dinh from Freeze Dried Foods did the Napier event; Sam Eames from Synlait was at the Ashburton event; Eileen Han from Matura Valley Milk spoke in Matura.

They were asked to describe what inspired them to want to work in the food processing industry, the tertiary study they did, their current role, what a typical day at work involves, what they enjoy, and don't enjoy, about their job, future work opportunities, and what they'd say to someone thinking about a career in our industry.



Our industry was represented by Ngan Dinh, from Freeze Dried Foods, second from left, in Napier

Feedback

Feedback from the teachers was very positive. For many, hearing from the young professionals was the highlight of the day, and provided them with valuable information they can share with their students. Feedback included:

- "The best part of the day was hearing the various pathways young people currently working in the NZ agriculture sector have taken to get there. The variation from degrees in Chemical and Process Engineering to Philosophy, English to Fine Arts was quite extraordinary. But all pushed that the main attributes to success in the sector were hard work and an ability to think and problem solve."
- "Hearing from young people and what experiences were most useful in school."
- "Hearing the knowledge, pathways and day in the life of young professionals."
- "The different career pathways of all the speakers – it really helps with my career planning."
- "The best thing was talking with different people involved in various roles to hear how they've gotten there, or what advice they'd give."
- "Seeing the passion people have for their careers."
- "I valued the young people's advice about promoting the industry to students."



In Ashburton, Sam Eames, from Synlait, second from left, talks to an attentive group

Our thanks to Amanda, Ngan, Sam and Eileen, and their employers, for supporting this initiative, and helping the Institute promote careers in the food processing industry.

News from NZIFST



NZIFST Conference 2021

Conference Chair, Don Otter, and his committee are making excellent progress developing the programme for our first conference for two years and it's going to be memorable: quality speakers, lots of social events and chat - and in Palmerston North!



2021 Conference Chair, Don Otter

Call for Abstracts

The call for abstracts is now open for the this Conference.

We invite you to submit an abstract for the and make a contribution to the our programme. All abstracts will be reviewed and submitters notified of acceptance.

Conference session themes will cover

- Food Safety
- Alternative/Non-traditional Proteins
- Sustainable Food Production
- Fermented Foods
- Drying Technologies
- Supply Chain and Disruptions
- Colloids and Food Structures
- New Technologies
- Sensory and Consumer Science
- Market Research
- (Pandemic) Risk Preparedness Food Safety

For more information on submitting an abstract and to make a submission, contact Rosemary Hancock, rosemary@nzifst.org.nz

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**THE NEW ZEALAND
INSTITUTE OF FOOD SCIENCE
& TECHNOLOGY INC**

New Members

NZIFST welcomes the following new members and new student and Graduate members

New Members

Craig Cooper	Hawkins Watts	Quality and Operations Manager	Auckland
Izabela Gladkowska Balewicz	Fonterra	Research Scientist	Palmerston North
RenSun Lee	Mantrose-Haeuser	Research Scientist	USA
Kongsamut Navapanich	Goodman Fielder	Packaging Technician	Auckland
Blesilda Oliveros	Frucor Suntory NZ Limited	Senior QA IMS Technologist	Auckland
Isabella Pearce	Tegel Foods	Technical Coordinator	Christchurch
Ari Penberthy	Talleys	Innovation and NPD Technologist	Auckland
Olivia Quinn	Canterbury Biltong	Quality and Efficiency	Christchurch
Laura Wolken	Food South	Operations Assistant	Christchurch
Swee Chan Wong-Phang	Wellington City Council	Food Act Verifier	Wellington

New Graduate Members

Nick Smith	Riddet Institute	Research Officer	Palmerston North
Fang (Flora) Wang	Auckland		
Dan Wu	Massey University	Research Technician	Palmerston North

New Student Members

Auckland University of Technology: Michaela Croudace.

Lincoln University: Yanyi Huang, Yvonne Liu

Massey University: Alaka Abdulquadri, Feng Ming Chian, Jessie Henderson, Vishaldeep Kour

The University of Auckland: Milesha Amarasinghe, Ada Chan, Ashlee Gen, Xinyi Wan, Adam Yeo

University of Otago: Elizabeth Cunliffe, William Hii, Natasya Surya

Wintec: Braden Tu'akoi.

Obituary: Selwyn Jebson FNZIFST

Selwyn worked for the NZ Dairy Research Institute from 1960-1979 and as a Senior Lecturer at Massey University from 1979 to 1996 in our the Food Technology Department.

Selwyn made an outstanding contribution to the profession of food science and technology through outstanding service in Research and Development, particularly through his research in milkfat and butter and evaporation and spray drying and technology transfer and education through his role as a University Lecturer over many years.

He received the Distinguished Service Award from the Dairy Industry Association NZ in 1999 and was a Fellow of the NZ Institute of Chemistry and the NZ Institute of Professional Engineers and of NZIFST. He was President of the NZ Dairy Science Association in 1968 and of the NZ Chemical Engineering Group from 1991-1992.

Selwyn retired from Massey University in the 1990s after an illustrious and very successful career as a teacher and researcher. He had an enormously creative mind and generated a huge array of research ideas and concepts and was always challenging the normally accepted practices in the dairy industry. During his academic career he was recognised as a very competent Food Engineer, particularly in the dairy area. During his Massey years Selwyn was constantly in the Pilot



Selwyn Jebson, in 2005

Plant planning new experiments, doing trials: pushing the boundaries of our knowledge in dairy engineering. He was a highly respected member of the dairy community and he has always had a strong involvement with DIANZ and NZIFST.

NZIFST President, Richard Archer remembers him well.

"Selwyn was unique, with his calliper on one shoe and his bicycle and his original technical ideas. He was a very sound chemical engineer who gave students a solid grounding but he liked to push boundaries in this technical developments.

Selwyn's other big technical passion was on-farm concentration of milk and he has a particular idea for a unique MVR system.

There is probably a whole generation of Dairy Diploma graduates – chances are, the people who are running the nation's factories now – who got their Principles of Engineering and Principles of Processing largely from Selwyn. That is quite a legacy in itself.

On retirement Selwyn got very interested in teaching older people how to use computers. They were the coming thing at the time. And his other big hobby was playing the organ – he had a pretty magnificent electronic pedal organ in the smallish Summerset house."

News from the Branches



Auckland Branch members enjoyed the Christmas Party at Garage Project's Cellar Door in Kingsland

Auckland

On the 26th of November, Auckland Branch held its Annual Christmas Party at Garage Project's Cellar Door in Kingsland. The evening began with platters and networking before we sat down for a game of "left hand, right hand", followed by a guided beer tasting with Ryan from Garage Project. During the night we were treated to some delicious Umu sourdough pizzas, dessert platters and a pub quiz to test our New Zealand knowledge. This was an extremely enjoyable evening and we extend our appreciation to Garage Project for hosting us, and to the committee behind organising a wonderful night.

Sarah Leakey



A sight to gladden the hear of an Auckland Branch beer connoisseur



Branch Members from Wellington and Manawatu celebrate the end of a trying year with a fiesta at Los Locos Cantina, Waikanae Beach. (Photo credit: Lara Matia-Merino)

Central

FAREWELL 2020 AND GOOD RIDDANCE!

By the time this communiqué is in your hands the festive season will be behind us, as will 2020, the most abnormal and awful of years most of us have endured. Surely (hopefully) the New Year we are broaching must see us emerge into something more typical? We have no way of knowing but with the dual expectation born of a fresh-faced New Year and the entry to a new decade no doubt this is what we all dream of. Seldom have we been more sincere in wishing our friends, colleagues and loved ones a “Happy New Year”.

Our last Branch Report signalled we would shortly be meeting up for our annual seasonal get together. In a year where we all spent rather more time zooming than schmoozing, and given our branch situation of dispersed membership over two main centres separated by 200km that enforces meeting in the virtual world as business-as-usual, we always look forward to the end-of-year event where we assemble somewhere along the road between Wellington and Manawatu. With the adversities we all endured in 2020 this time it was especially satisfying to anticipate an evening in the real world featuring food, friends and frivolity. It’s hard to get into that spirit through a remote link, and sharing food and drink over the internet is a technical challenge still to be resolved.

So on a delightful Friday evening in late November two convoys migrated from the north and from the south to meet at a quirky Mexican cantina, Los Locos, on the fringes of Waikanae Beach on the Kapiti Coast. After the past few years, where our annual celebratory bash achieved only moderate attendance, this year 28 members, evenly distributed between our two centres enjoyed this Mexican fiesta

of tortilla, nachos, salsa, jalapenos and quesadillas, washed down with Margaritas, sangria and beer. Fortunately for those carrying car keys there was also an impressive array of mocktails and “safe” non-alcoholic options. Our hosts provided an extensive selection of Mexican headwear so excessive sombreros capped the “loud shirts” we were encouraged to wear. Not that it was a competition, but Chairman Ben demonstrated his excessive taste in couture with a shirt that really should have been equipped with a volume button. Also notable were President Richard Archer and wife, Deb who wore co-ordinated floral beach-shirts. Classy!

We were not alone in making this idiosyncratic venue our end-of-week destination. Every seat in the house was taken up by a seething mass of humanity celebrating the precious freedom of a covid-free community. The spirit of *feliz navidad* pervaded the entire venue. All that was missing to transport us to Guadalajara, Tijuana or Chihuahua was the serenade of a mariachi band. It was fortunate that our hosts had reserved to our exclusive use the entire upstairs space, accessed through a maze of passages and stairways that had one praying that an emergency escape was not needed. Thus we were provided the privacy to really let our hair down (in a very seemingly way befitting the professionals we all are, of course).

Our thanks are due to event organiser Amanda Thompson. She has set a challenging bar to be cleared by next year’s delegate.

And so at the end of a wonderfully festive night we bid farewell (and good riddance) to 2020, and wished each other a more normal 2021, a wish we now extend to all our colleagues throughout the country.

Allan Main FNZIFST



NZIFST - Waikato Christmas night and Food quiz

NZIFST members (left) participating in the taste test

Waikato

The NZIFST Waikato branch Christmas function was held at "Hazel Hayes" on December 2nd and attended by 20 members and partners. It was great to see new faces joining for the night.

We enjoyed a chippie taste test as the first of event of the evening and it brought smiles and laughter to many. Members were given 10 different types of chips and extruded snacks and were asked to identify the name of the chippies/snack product by taste. The winning team was able to identify 8/10 chippies correctly.

The delicious dinner was enjoyed by everyone. Our dinner was finished off with a challenging quiz with appropriate prizes for the winners and

chocolate for all members. The quiz had been put together by Colin Pitt and produced discussions and new knowledge for most of the members. It was a wonderful and fun night for everyone to recap on our end of the year 2020 and to discuss suggestions for 2021.

A thank you to those who have contributed to the Waikato branch throughout the years. 2020 was a difficult year for the branch as most of the plant visits and branch gatherings had to cancel. We are moving onwards, wrapping up the year with Christmas, looking forward to seeing what events and FED talks will be showcased ahead.

Chathurika Samarakoon

Going Bananas!

Henry Battell-Wallace, Student, Massey University Albany

This article was awarded second equal place in the Food Tech Solutions NZIFST Undergraduate Writing Competition 2020. The annual competition is open to undergraduate food science and food technology students who are invited to write on any technical subject or latest development in the food science and technology field that may be important to the consumer.



Panama Disease threatens the supply of bananas worldwide

It may surprise some that the variety of banana we know and love is only in our supermarkets because of a fungus. But this is not the only surprise – it's looking like history may soon repeat itself.

Our previous favourite banana was the Gros Michel. It was perfect for export, producing huge bunches of large, flavoursome bananas which were very resistant to damage (Ploetz, 2005). The reason you won't find them today is the fungus infection, Fusarium wilt tropical race 1 (TR1) caused by the organism *Fusarium oxysporum* f. sp. cubense, which infects banana plants and causes Panama disease (Li et al. 2013).

The fungus can infect the roots of all banana plant varieties but Panama disease only occurs in non-resistant varieties. In these plants, the infection progresses into the vascular system in the trunk and leaves, causing the leaves to wilt, the trunk to rot and, eventually, plant death (Ploetz, 2006; Ploetz, 2015).

Panama disease quickly spread, causing rapid worldwide destruction of Gros Michel plantations from the 1940s until they were completely gone from our supermarket shelves by the early 1960s (Li et al., 2013).

Enter the Cavendish banana

In the 1950s, Cavendish bananas were discovered to be resistant to TR1, leading to them being quickly commercialised. The bananas' disease-resistance and profitability lulled the industry into a false sense of security and Panama disease-related research dramatically slowed down (Ploetz, 2005).

However, In the 1990s, Cavendish banana plantations in South East Asia began to experience substantial losses. The cause was soon identified as Fusarium wilt tropical race 4 (TR4) - a close relative of the Panama disease-causing TR1 fungus to which the Cavendish was not resistant (Ploetz, 2006).

Controls to stop the spread initially limited the disease to South East Asia and northern Australia but over the last decade, the disease has had a devastating effect across most Asian and Australian growing regions. It has now spread to Africa, the Middle East and, most recently, to India and Colombia (Dale et. al., 2017; Dita et al., 2018; Garcia-Bastidas, 2019; Damodaran et al., 2019).



Panama disease-infected bananas rot and become unfit for human consumption

How did we get here again?

Like the Gros Michel, Cavendish bananas are planted in vast monocultures of clones, leaving all plants vulnerable to the same diseases due to the lack of biodiversity. Furthermore, most production is in large permanent plantations which are close to international contact points where produce is exported and banana-growing materials are traded between different growing regions. This can allow rapid spread of disease between and within growing regions (Stover, 1986; Ploetz, 2015).

What effect would this have?

The original Panama disease outbreak caused a conservatively estimated \$NZ6 billion impact (in 2020 terms) on banana growers worldwide, without considering the lost income sustained by the vulnerable farm workers (Ploetz, 2005).

Today, bananas are the top-selling fruit in New Zealand (McIlraith, 2018). Worldwide, they are the eighth most important food crop and the fourth most important crop in developing nations (Ploetz, 2015). Cavendish bananas represent more than 40% of the \$NZ55.6 billion worldwide banana production and 99% of the \$NZ8.34 billion export banana production (FAO, 2018; Ploetz, 2015). Without a viable long term solution, Panama disease could have devastating effects worldwide.

What is being done?

Control is difficult - the TR4 fungus can live in the soil for over 40 years and it cannot be controlled or removed using fungicides (Ploetz, 2006). Protecting other plantations in a newly infected region is also very difficult. Therefore, much effort has gone into controlling the spread.

TR4-free regions are being protected using biosecurity-based exclusion techniques and educating stakeholders on the risks of TR4 and what they can do to help stop the spread (Dita et al., 2018). For places where the infection has already taken hold, there have been some advancements in the understanding of how we can manage the fungus to keep using the land for Cavendish banana production. Traditional soil management techniques such as crop rotation, cover crops, and organic amendment (the application of compost mixtures with specific microorganism and nutrient mixtures) has shown some success in managing Panama disease by creating a soil environment to suppress the fungus in the soil and promote competing soil microorganisms (Pattinson et al., 2014; Dita et al., 2018).

Why not cross-breed the Cavendish?

Cross-breeding with other bananas would seem like a potential solution but this is very difficult and time consuming. Cavendish bananas are triploids, meaning they have three sets of DNA chromosomes (Dita et al., 2018). While this is rare and usually fatal in humans, it is common in plants as it gives good fruit characteristics, but the uneven number of chromosomes often makes the plant sterile.

Until 2003, female Cavendish plants were thought to be sterile but a study done by Aguilar Morán (2013) managed to separate 186 seeds by pollinating 20,000 Cavendish clusters. Just 20 tetraploid plants (four sets of chromosomes) could be grown from these 186 seeds. As the new plants are tetraploid, they can be used for crossbreeding with resistant diploid (two sets of chromosomes) banana varieties to give TR4-resistant triploid bananas which are similar to Cavendish. However, the cross-breeds have so far failed to achieve the qualities that the Cavendish possesses (Stokstad, 2019).

What about using a different banana?

Currently, there are no commercially acceptable replacements for the Cavendish banana. Traditional diploid banana varieties used for crossbreeding (and their current crosses) have poor fruit and production qualities. While traditional breeding techniques are being used to develop new varieties, these can take several generations, with each generation having a long delay between them. This means long development times for potential new varieties (Dita et al., 2018; Stokstad, 2019; Ploetz, 2015).

What's our best hope right now?

Gene-editing technology may be the saviour here. Dale et al. (2017) used two methods to convey resistance to Cavendish banana plants for field trials in Australia from 2012. The first method used a gene from a wild banana from which domestic varieties originate. A bacterium which only infects plants and has an inherent ability to insert genes in plants, called *Agrobacterium tumefaciens*, was used to insert this gene into the banana DNA.

For the second method, a gene that was shown by Paul et al. (2011) to give ladyfinger bananas resistance to TR1 was extracted from a nematode and inserted into the banana DNA using a virus which only infects plants: the cauliflower mosaic virus (Dale et al., 2017). All gene-edited varieties were screened to ensure the editing worked as intended and the plants were monitored for any other effects which may have come from the gene editing.

The researchers then planted around 10 clones each of the gene-edited lines alongside traditional banana cultivars in fields which had been infected with the fungus for over 20 years. TR4-infected materials were also buried around the plants. In multiple field trials, all gene-edited lines showed a substantial improvement over traditional plants. Two gene-edited banana lines (one from each editing method) were completely unaffected by the fungus and showed no effect on the fruit.

While this result is promising, these gene-edited plants are unlikely to reach the market until at least 2023 (Stokstad, 2017). This may not be soon enough to avoid a banana shortage and the destruction of livelihoods in growing regions. The last and toughest question is: will consumers accept gene-edited bananas?

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