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food

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australia

OFFICIAL PUBLICATION OF AIFST

RECENT DEVELOPMENTS IN CULTIVATED MEAT PRODUCTION

PLAGUES, PESTILENCES AND PANDEMICS

FERMENT TO BE?

FOOD SAFETY: be prepared for the challenge



Food Innovation Australia^{Ltd}

Regulars
By the Numbers
The Pulse
Sensory
Fast Five



FOOD SAFETY: BE PREPARED FOR THE CHALLENGE

Assuring food safety is more complex than ever before. As the number of ingredients and suppliers multiply, production technologies change, and consumer demands for transparency grow, supply chains are becoming increasingly intricate. To remain competitive in this environment, food companies must continually build and develop their food safety capabilities.

Already enjoying an international reputation for being a source of clean and green foods, Australia's continued excellence in food safety outcomes will see our food and agribusiness sector well placed to capture a growing share of the global market.

So, just how can Australian food businesses ensure they are protecting, nurturing and enhancing our enviable reputation and track record?

According to its *Sector Competitiveness Plan 2020*, Food Innovation Australia Limited (FIAL) places industry having access to cutting-edge knowledge and resources as critical.

As one of the Australian Government's Industry Growth Centres, FIAL supports Australian food and agribusinesses to grow their presence and compete in the global marketplace. It sees the upskilling of industry as essential. Without it, businesses will not be able to develop the innovative, cost-effective and differentiated offerings needed for the sector's sustained growth.

FIAL's general manager of innovation, Dr Barry McGookin, maintains that food safety is no longer just the domain of technical and production functions.

"Food safety needs to be part of the embedded culture at all levels of the organisation, it is not about shuffling forms and gathering data," Dr McGookin said.

"It is a company-wide, end-to-end business responsibility, so it is vital that board members are adequately equipped to rise to the challenge and recognise, evaluate and prevent food safety risk," he said.



Recently, FIAL announced a partnership with the Australian Institute of Food Science and Technology to deliver a new interactive online workshop - Food Safety Governance Course for Directors. Specifically designed for senior managers, executives and company directors, this workshop provides a governance overview to support the production and sale of safe food.

"The development of this food safety governance course for directors was in direct response to an industry need for increased support in this area. We encourage all directors, executives and senior management to register their interest for the next session," Dr McGookin said.

The Food Safety Governance Course for Directors helps participants understand the importance of food safety governance and their responsibilities and roles in assuring

food safety performance. It also discusses tools to monitor and verify food safety performance and the essentials of good food safety governance.

To view upcoming events hosted by FIAL and to express interest in future workshops, visit: www.fial.com.au/eventscalendar

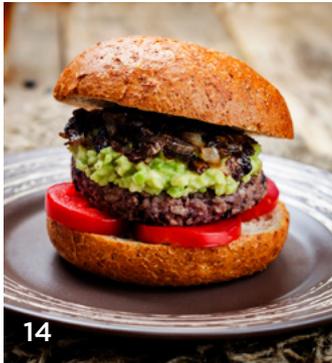
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Food Innovation Australia^{Ltd}



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Food safety: be prepared for the challenge.

food australia

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Food for Thought

As I write this from my desk at home, the AIFST annual convention is drawing to a close.

The continuing challenges of the COVID-19 world we are now living in requires us to adapt and innovate, and we have.

This year's convention has been like no other. Still with a diverse line up of speakers and topics, the key difference - it was delivered 100 per cent virtually with almost all of our speakers delivering their presentations in real-time from many different parts of the globe. I would like to thank all of our speakers and partners - without your support, our convention this year, and indeed every year, would not be possible. So THANK YOU!

In this winter edition of *food australia* we feature articles on some of the topics addressed at the convention, speaking to the theme: food science revolution - building a sustainable future. We look at alternative proteins, what can we learn from the 'forgotten pandemics', gut health, cultivated meats and the role of food science and technology in responding to humanitarian crises.

The AIFST website has a page dedicated to [Humanitarian Food Science and Technology](#) (HFST) and I encourage you to visit this page to learn more about this important topic.

In this edition we also feature our food research roundup, covering the Australian Research Council's (ARC) current linkage projects, and look at the benefits of engaging a food science and technology consultant.

The AIFST 2020 convention has provided us with a snapshot of the food science revolution. We will continue to look to the future to advance and inspire all food sector professionals through education, collaboration and recognition to champion a robust, innovative science-based Australian food industry to meet future food needs.

As always, I invite and encourage all members to take an active role engaging with the Institute. Talk to us in 2020.

Fiona Fleming

B. App Sc (Food Tech); MNutr Mgt;
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By the numbers - Australian food security and the COVID-19 pandemic

The COVID-19 pandemic caused significant disruption to many aspects of life in Australia and internationally, including changes in consumer behaviour.

These changes included a surge in demand for many consumer staples, caused by panic buying, and related concerns regarding food security.

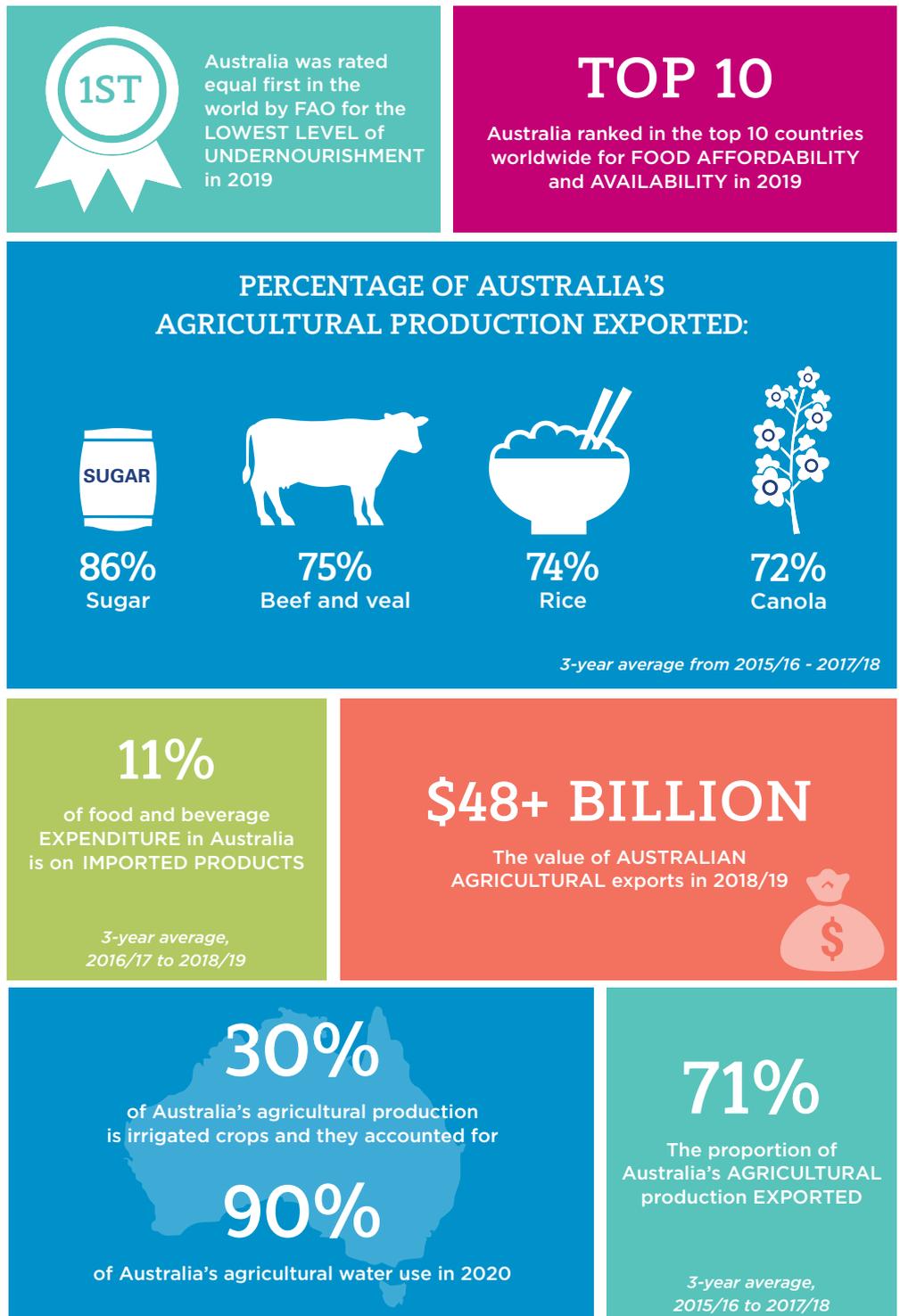
A study by ABARES published in April 2020 found, despite temporary shortages of some food items, Australia does not have a food security problem and that empty supermarket shelves resulted from an unexpected surge in demand.

Australia is not only one of the most food-secure countries in the world, with ready access to a wide variety of healthy and nutritious foods for domestic consumers, but it also plays a part in the food security of other countries, exporting around 70 per cent of all agricultural production.

Australia is a net food exporter, producing more food than required for domestic consumption. The vast majority of our food is produced here in Australia, and domestic production more than meets our needs even during drought years.

This means our domestic consumption generally remains stable while exports may vary, absorbing the ups and downs in annual production associated with Australia's variable climate and seasonal conditions.

We do not produce everything we like to eat, however, and imports account for around 11 per cent of food consumption by value. These imports provide access to manufactured food and beverages, different varieties of some items, and out of season fresh produce.



Source: ABARES 2020, Australian food security and the Covid-19 pandemic, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. CC BY 4.0. <https://doi.org/10.25814/5e953830cb003>



A SANITISING PIVOT

The COVID-19 pandemic has seen many businesses pivot to capitalise on new opportunities arising from the higher demand for certain products. We took a look at some that have adapted their food and beverage businesses to respond to the exponential rise in demand for hand sanitiser.

Trisco Foods

In response to the coronavirus pandemic, Queensland's family-owned Trisco Foods developed and launched its own brand of clinical-grade hand sanitiser in just three weeks.

Trisco Foods normally produces syrups and thickeners, but started producing hand sanitiser for aged care centres and health departments across Australia.

CEO Mike Tristram said the company had been impacted by the COVID-19 outbreak and was looking for new opportunities to utilise their product research and development and mass production capabilities.

"To effectively fight COVID-19 now, and into the future, we are going to need a lot of hand sanitiser," Mr Tristram said.

"After some initial feasibility studies, we worked out we could quickly ramp up production of a product that met the highest standards and could be used in a range of clinical situations," he said.

The company began producing 35,000 litres of hand sanitiser every week from its Carole Park factory, with volumes increasing as safety systems and processes were expanded.

Keeping distillers and brewers in business

With coronavirus forcing pubs and clubs to close, brewers and distillers faced a huge, sudden drop off in demand. Many were also well-positioned to utilise their resources and facilities for the now high-

demand product, and re-focused their expertise to produce hand sanitiser. Brisbane's Underground Spirits is one such example.

Underground Spirits quickly swivelled its focus from producing artisan gin to producing pharmaceutical-grade hand sanitiser. While the company was busy distributing thousands of litres of hand sanitiser to those most in need - including nurses, doctors, paramedics, pharmacists, dentists and even the homeless - it also responded to a call for help from Services Australia.

Services Australia was facing mass closures of its Centrelink shop fronts across eastern Australia due to a lack of hand sanitiser for staff. Underground Spirits managed to get 1,200 litres of hand sanitiser out to Centrelink branches within 24 hours, and therefore helped this critical service keep its doors open. Underground Spirits distributed 4,000 litres during the first week of production.

Gin distilleries

Gin has experienced a rise in popularity in recent years, but the coronavirus pandemic gave rise to a new type of demand. A number of Australian distilleries have repurposed their existing production facilities to help meet national demand for hand sanitiser products and, in turn, kept their workers employed.

Four Pillars co-founder Stuart Gregor said their business was braced for a huge drop in its wholesale business as major hotel groups and restaurants closed. While retailers



would still be selling their Four Pillars gin, the question was how long would it last, so the decision to start manufacturing hand sanitiser was an obvious one.

In New South Wales, Cape Byron Distillery, which makes the Brookie's Byron range of gin, and Sydney-based Archie Rose Distilling Co, also started producing hand sanitiser.

Archie Rose reallocated its entire spirits production capacity to produce as much hand sanitiser as possible, and founder Will Edwards said his team was able to produce the new product in fewer than 10 days.

"With the required federal licenses, dangerous goods approvals, access to raw materials, and expertise, we are in a very unique position to manufacture this essential product, leading to the tough but clear position to divert our spirit production capacity to manufacture hand sanitiser," Mr Edwards said.

Hurdle Creek distillery makes a double pivot

Hurdle Creek Still, a small artisan distillery in north east Victoria's King Valley, has taken a couple of unexpected turns in recent months, showing remarkable adaptability in the face of significant challenges.

The distillery usually makes spirits from locally sourced grain. But the summer bushfires, closely followed by the coronavirus pandemic, saw the business pivot not once, but twice in recent months.

The first pivot came when the distillery partnered with local wineries that had a surplus of wine that wasn't up to selling quality. Recognising the sudden widespread shortage of hand sanitiser, the distillery set about distilling the surplus wine to supply to pharmacies and other businesses to compound into sanitiser. It wasn't

long though before industrial alcohol supply returned.

Then came pivot two, when the distillery was contacted by local fruit growers who had fruit ready to harvest, but due to the COVID-19 shutdown had lost their usual farmers market and restaurant customers. As a result, the distillery has developed a number of small run liqueurs using persimmon, yuzu and kiwi fruit infused into local King Valley grape spirit.

Simon Brooke-Taylor MAIFST, Hurdle Creek Still's director, said customers have responded well to Hurdle Creek Still's innovative offering. "While demand for our regular list of spirits has steadily recovered as the lock down has unwound and visitors have returned to the North-East, customers have expressed interest in trying our



new range of seasonal and locally produced fruit-based liqueurs when they are released - likely to be in mid-late 2020," Dr Brooke-Taylor said.

Addressing malnutrition with FST

Malnutrition is a serious problem that affects millions of people worldwide.

The health, social and economic impact of both chronic and acute malnutrition on people and communities can be devastating and long-lasting.

Food science and technology (FST) could play a key role in responding to humanitarian crises and addressing malnutrition by formulating products using locally sourced raw materials and developing low-cost processing technologies. Such an approach could not only help prevent malnutrition, but could also aid emergency response and address the rehabilitation and development phases following an emergency.

The effective use of FST in preventing malnutrition in children has been demonstrated in work carried out by an NGO in Kesho Congo, in the Democratic Republic of Congo (DRC). This project used a nutritious biscuit enriched with an extract made from locally grown cow pea leaves which are rich in protein and micronutrients.

Trials carried out in collaboration with health professionals in general hospitals in Bukavu showed these



fortified biscuits could be effectively used as a convenient and low-cost method to prevent and treat malnutrition in children.

Further work will be carried out to optimise the formulation, scale up the process and develop a sustainable business model for production.

The project demonstrates that FST can play an important role in

addressing malnutrition in countries such as DRC which are regularly impacted by pandemics (such as Ebola virus and now COVID-19), by building resilience, empowering local communities and creating small community-based agri-food enterprises.

For more information on the project see: www.keshocongo.org



Billion dollar blueprint for Australian seaweed

AgriFutures Australia has announced a new project with the Australian Seaweed Institute to develop a blueprint for the emerging seaweed industry in Australia.

The Seaweed Industry Blueprint project is designed to unite existing seaweed research and aquaculture efforts into an action plan to accelerate investment and development for the industry in Australia. As a result, the industry is forecast to create new jobs,

help protect and regenerate waterways and contribute to greenhouse gas reduction.

Australian Seaweed Institute CEO, Jo Kelly, said the current global market for seaweed products such as food, cosmetics, nutraceuticals, animal feed and fertiliser is estimated at nearly \$16 billion, and is expected to double in value by 2025.

"Australia has ideal growing conditions and a huge export

opportunity for high-value bioproducts from native Australian seaweed."

"The opportunity for an Australian seaweed industry is significant from an economic, environmental and social impact point of view," Mrs Kelly said.

The project forms part of AgriFutures Australia's Emerging Industries Program, which is focused on identifying and supporting the emergence of agricultural industries that can reach or exceed a \$10 million per annum threshold in the next five years.

The initial objective of the blueprint is to outline the seaweed industry opportunity for Australia.

The second objective is to create an industry development blueprint with appropriate milestones to grow the industry to over \$1 billion by 2040.

For more information on the project see: <https://www.agrifutures.com.au/news/blueprint-for-a-billion-australian-seaweed-industry/>

FIAL 2020 sector competitiveness plan released

Food Innovation Australia Ltd (FIAL) has released its 2020 Food and Agribusiness Sector Competitiveness Plan (SCP) which outlines a 10-year vision and strategy for the continued growth of Australia's food and agriculture (F&A) industry.

FIAL's SCP report is reviewed and revised annually to reflect market forces shaping the sector, ensuring it remains current and relevant. The 2020 report identifies some of the challenges and opportunities facing the food and agriculture sector, including key knowledge priorities and areas of regulatory reform that impede business's ability to innovate and grow.

The SCP was developed in response to the federal government identifying the food and agriculture sector as one of six priority areas for the economy. The SCP aligns with the Industry Growth Centres Initiative (IGCI) priorities, with a particular focus on advocating for innovation and value-adding activities throughout the F&A chain. For more information, visit: <https://fial.com.au/scp2020>

DTS Food Assurance rebrands itself



Dairy Technical Services (DTS) was founded in 1954 to provide expertise to Australia's dairy industry. Since that time, the company has stood by the Australian food industry as a significant partner, maintaining accreditation with the National Association of Testing Authorities (NATA) continuously since 1961.

In 2016, Bureau Veritas partnered with AsureQuality to acquire DTS, which enabled the company to become a complete solution provider offering the full range of services from testing to inspection and certification.

Following the integration of DTS into the Bureau Veritas AsureQuality (BVAQ) joint venture on 1 July 2020, DTS Food Assurance will adopt the BVAQ brand name and logo for all their businesses in Australia. The company said they will continue to provide the same high standards of testing and quality service delivery they are known for.

DTS Food Assurance is a leading Australian food assurance service and operates the largest food microbiology, chemistry and allergen laboratories in Australia.

Lion sets the carbon neutral benchmark

Australian brewery Lion has become the first large-scale carbon neutral brewer in Australia, following its ambitious carbon reduction program and acquisition of certified carbon credits.

Lion has been making moves to become more carbon friendly since 2015, when the company set a target to reduce its carbon footprint by 30 per cent by 2025. The company said it established a 'whole brewery' carbon reduction approach across its Australian breweries to help it reach this goal.

Their programs included energy efficiency initiatives, biogas utilisation, rooftop solar, renewable energy power purchase agreements and providing brewers grain to reduce livestock emissions.

The company said it has achieved a 28 per cent reduction (approximately 30,000 tonnes) in its carbon footprint since 2015. It plans

to meet the full carbon reduction target by 2025 and has gone one step further, committing to also use 100 per cent renewable electricity to brew its beers by 2025.

Lion CEO, Stuart Irvine said resetting their emissions to net zero sends out a strong message.

"We are deepening our collective responsibility to measure, manage and reduce our emissions, and we remain fully committed to doing so, despite the challenges we are facing in our business and across the industry as a result of COVID-19.

"Speed is of the essence in stabilising the climate. That is why we are effectively throwing a safety net over our remaining operational CO2 footprint," Mr Irvine said.

Tasman Environmental Markets, Australia's largest buyer of carbon offsets, is providing Lion with a portfolio of verified projects to offset its remaining organisational carbon



footprint. Lion will focus on carbon abatement projects that deliver bush regeneration and protect vital habitat and food sources for native wildlife.

Coronavirus guidelines released for produce suppliers

The Produce Marketing Association Australia-New Zealand (PMA A-NZ) released guidelines in April, for the fresh produce industry during the COVID-19 pandemic.

The guidelines were developed by PMA A-NZ to provide general guidance to assist producers of fresh produce to plan for and mitigate the risks posed by COVID-19 to their employees, their business and the supply of fresh produce to consumers.

This includes:

- Protecting the health and safety of a business's employees, their families, and the broader community
- Ensuring the ongoing supply of fresh produce to Australian and New Zealand consumers, thereby supporting good nutrition and food security in this challenging time
- Facilitating business continuity to ensure businesses survive and

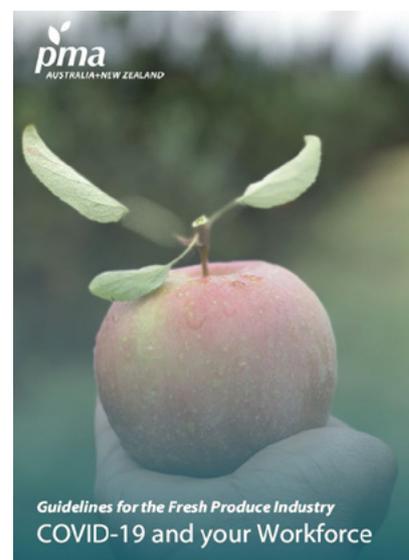
there is ongoing job security for the workforce.

Head of Food Safety at PMA A-NZ, Deon Mahoney, said PMA A-NZ released the guidelines to help the fresh produce industry navigate through the challenges posed by COVID-19.

"We needed to ensure we are doing everything we can to reduce the risk in fresh produce businesses to ensure there is business continuity so we can continue to provide fresh fruits and vegetables to consumers."

"Now more than ever, it's important to consume fresh fruits and vegetables, which can help boost the immune system and overall health," Mr Mahoney said.

PMA A-NZ has been working on a consumer-facing campaign to build trust in the safety of fresh produce during the COVID-19 pandemic. They are encouraging consumers to add their voice on what they love most about Australian farmers and produce



by uploading an image to social media with the hashtag #JoyofFresh.

PMA A-NZ has released a range of resources to help fresh produce businesses succeed during the COVID-19 pandemic, which are free to the industry via www.pma-anz.com.

AIFST non executive directors - movements

INCOMING DIRECTORS

AIFST is pleased to welcome three new non executive directors to the Board. Suz Allen, Deon Mahoney and John Kavanagh joined the Board following the 2020 AGM held in May.

Deon Mahoney

Deon Mahoney is a fellow of AIFST and possesses considerable experience across food science and technology. Over his career his roles have included the development of food safety policy, microbiological risk assessment, risk communication, development and enforcement of food legislation, quality assurance and training and education.

As Head of Food Safety at PMA A-NZ, Mr Mahoney provides high level technical support and guidance with the goal of ensuring the safety and suitability of fresh produce.

Mr Mahoney completed post-graduate studies at University of Sydney, including a Master of Science in Agriculture, and retains a keen interest in evolving advances in food science and technology.

Mr Mahoney has previously worked for the World Health Organisation and the Food and Agriculture Organisation, as well as with Food Standards Australia New Zealand and Dairy Food Safety Victoria. In these roles he has developed and published a wide range of technical guidance material, provided forward-looking scientific advice addressing factors that impact the safety of food products, and been actively involved in Listeria incident monitoring and response.

John Kavanagh

John Kavanagh has spent more than 25 years in leadership roles across the food and healthcare industries. Most recently, he was CEO of Integria Healthcare, an Australian-based, privately owned business that manufactures and sells natural healthcare products throughout Australia and New Zealand, North America, Asia and Europe. As Integria's CEO, Mr Kavanagh also sat on the board of the industry



Deon Mahoney.



John Kavanagh.



Suz Allen

association (Complementary Medicines Australia) for three years.

Prior to Integria, for nearly eight years Mr Kavanagh was CFO of George Weston Foods and also served on the boards of a number of domestic and international joint ventures. Prior to that he was director of finance and IT at GlaxoSmithKline Consumer Healthcare (ANZ).

After completing an Economics degree at Macquarie University, Mr Kavanagh started his career as a finance professional with Price Waterhouse, qualifying as a chartered accountant, then becoming a registered auditor in private practice.

During his career, Mr Kavanagh has served on numerous voluntary boards and committees, generally taking on the treasurer's responsibilities. Mr Kavanagh has been a member of the Australian Institute of Company Directors since 2011.

Suz Allen

Ms Allen has held the role of director sensory & consumer science at Arnott's Asia Pac and International for the past eight years, having been with the business close on 16 years. Throughout her career, Ms Allen has consulted to a large number of FMCG companies as a sensory specialist covering a wide range of products including fresh and processed foods, beverages, pet food and personal/home care.

Academically, Ms Allen has completed a Science degree in physiology and psychology, a Master's degree in cognitive science, an MBA in

marketing, a graduate certificate in gastronomy and more, and continues to have an insatiable curiosity.

Ms Allen is currently the director of sensory and consumer science at Arnott's Asia Pacific and manages the core sensory discipline there, with current responsibilities for teams in Australia, Indonesia and Malaysia.

Key career achievements have included long-standing client partnerships at senior management level, peer-reviewed publications, successful food innovation launches and tailor-making product and strategy to meet specific consumer segments.

Ms Allen is adept at turning ideas into profitable business outcomes and looks forward to bringing her ideas and passion for innovation to the AIFST Board. She believes it is more important than ever to utilise networks, connect members and promote the industry as we continue to navigate through a changing professional landscape.

OUTGOING DIRECTORS

Trent Hagland and Dr Steven Lapidge retired as non executive directors, both having served a three-year term with the Institute. The Board and AIFST team thank Trent and Steven and acknowledge their contribution to the Institute throughout their term.

Fiona Fleming also retired as managing director, having served two consecutive three-year terms. Mrs Fleming will continue with AIFST in the role of chief executive officer.

Dr Craig Shadbolt moves to new role at NSW Food Authority

Dr Craig Shadbolt commenced a new role as principal food safety scientist with the NSW Food Authority in December 2019. In this role Craig is responsible for leading a range of projects and providing technical input into food safety issues at NSW and national levels.

Dr Shadbolt is passionate about reducing the burden of foodborne disease and ensuring Australian businesses are well regarded and have the best possible opportunities for market access.

Prior to this appointment, Dr

Shadbolt was with the NSW Food Authority and NSW Department of Primary Industries Biosecurity and Food Safety Branch as food incident response and complaints manager.

Dr Shadbolt has previously held roles with the Australian Government Department of Health and Ageing and Food Standards Australia New Zealand, providing technical advice and input into food safety policy and standard setting.

Dr Shadbolt has a background in food microbiology and obtained his PhD from University of Tasmania.



Julie Cox launches Provenance Legal

After nearly 20 years advising food and beverage businesses across the globe, Julie Cox has launched Provenance Legal – a boutique law firm dedicated to the Australian food and beverage industry.

Prior to launching Provenance, Ms Cox was a special counsel at global law firm Baker McKenzie in London and Sydney where she specialised in food regulation, consumer law and intellectual property matters across the entire product lifecycle.

Ms Cox played a pivotal role in the development of the firm's food law practice across Asia Pacific and worked closely with food industry bodies to develop awareness of various challenges facing the

industry such as non-tariff barriers to trade.

With dual degrees in law and science (majoring in biochemistry), the regulation of food was a natural progression for Ms Cox, who spends much of her time advising food retailers, manufacturers, importers and exporters, particularly in the alcohol, dairy, health and infant formula industries.

While passionate about the entire food industry, Ms Cox has a particular interest in the food/medicine interface, the regulation of geographic indicators and sustainability initiatives in the food sector.

Ms Cox understands the need for



pragmatic advice in such a highly regulated area that is under constant pressure to innovate.

"Food businesses are looking for better value from their legal service providers, now more than ever," Ms Cox said.

Dr Denise Hamblin appointed head of sensory at Kantar

Dr Denise Hamblin has recently transitioned from national sector head - FMCG, to head of sensory, as part of Colmar Brunton's integration into Kantar Australia. Dr Hamblin brings with her a wealth of knowledge and a decade of leading the sector at Colmar Brunton.

Dr Hamblin will continue to lead her team of researchers to instil sensory and product optimisation approaches into the existing Kantar innovation framework.

She will continue to champion

thought leadership via the Millennium Monitor, track consumer trends and behaviour, and lead sensory qual, product and preference mapping, central location tests, expert trained panels, home use tests and claim substantiation research programs.

"Increased global capability and a larger network will help sharpen the context for Australian insights and open more doors to test more global innovations," Dr Hamblin said.



Selina McNulty joins Patties Food Group



Patties Food Group has appointed Selina McNulty as group quality manager.

Ms McNulty comes to the role with more than 20 years of global experience in the FMCG industry, most recently as brand manager at the Coles Group, where she led the implementation of Australia's first supermarket short shelf-life fresh cut fruit and vegetable offer. Ms McNulty has extensive experience across different manufacturing disciplines and processes and has strong relationships across the sector.

Prior to Coles she worked for a range of food suppliers both in Australia and Europe, managing food

safety and quality within small and large companies.

Ms McNulty has a Bachelor of Applied Science majoring in food science and biotechnology from University of Ballarat, and is a member of AIFST.

Ms Simone Anderson, group operations director at Patties Food Group, said they are delighted to welcome Ms McNulty to the team.

"Her wealth of experience working for some of the world's most respected food brands will help Patties continue to produce top-quality products beloved by all Australians," Ms Anderson said.

Dr Vicky Solah joins Murdoch University

Dr Vicky Solah joined Murdoch University in April this year as an Associate Professor, Food Science and Nutrition, in the College of Science, Health, Engineering and Education.

Dr Solah's research career began at the Department of Agriculture based in Yanco and Sydney. Dr Solah said that working with Professor Barry McCleary, Megazyme Australia (now Megazyme International Ireland) was a turning point in her career and made her realise the importance of a good mentor in career success.

Research with Megazyme resulted in Dr Solah's first international publication in 1994, on high amylose starch, an area of research she is still passionate about. In 1997, Dr Solah joined the Nutrition and Food Science research and teaching team at Curtin University.

Dr Solah's research interests are at the interface between food science and human nutrition. Her research is closely aligned with industry in Australia and internationally. Dr Solah is proud to have collaborated on research projects in Australia with Sydney University (satiety), CSIRO (high amylose wheat and health) and AEGIC (noodles and oats) and

internationally with Italy (noodles and health), Japan (dairy), China (noodles and oats), Turkey (bulgur), Singapore (steamed bread), India (chapatti) and Canada (viscous polysaccharides and health).

Dr Solah was awarded a Lifetime Fellowship by AIFST in 2018 and was nutrition division chair of AACCI (American Association Cereal Chemistry International) - now Cereals & Grains Association - from 2016 to 2018. She has been an active member of AIFST for more than 20 years as a committee member, organising the 2018 summer school in Perth, supporting WA workshops and more recently as a member of the food australia publication committee.

Dr Solah is part of the team developing Murdoch University's new Bachelor of Food Science and Nutrition, which enrolled its first intake of students in 2020.

Dr Solah said Murdoch University's Food Futures Institute and the Australian National Phenome Centre, plus The Agri-Innovation Precinct in the Peel Business Park in Nambelup, WA, will provide new resources and opportunities to teach and conduct research linking industry, agriculture, food, nutrition and human health.



"The most rewarding part of my career has been working with research students and I'm looking forward to learning new, exciting things in the future from students," Dr Solah said.

"I have had a wonderful, happy career so far, and I am very excited to join Murdoch University and be part of building a great food science and nutrition team," she said.



Continuing Professional Development

Education and continuing professional development

Nelson Mandela said education is the most powerful weapon which you can use to change the world.

The world of food science and technology is changing rapidly and, as an industry, we need to ensure we keep up to date with changes.

Education is a major focus for AIFST, built around our key priorities of grow, learn, connect and champion.

Why a CPD program?

In today's increasingly competitive and changing world, food scientists and technologists must stay at the cutting edge of new developments throughout their careers. It is no longer possible to rely on basic studies or on-the-job training to provide professional advice and service to our employers, customers and clients.

This means to continually improve our technical knowledge and skills we need to engage in continuing professional development (CPD). AIFST also recognises that in modern organisations, food scientists and technologists are increasingly responsible for developing their own careers. CPD allows you to enhance your future.

A CPD program reflects the professionalism of the members, improves their professional standing and enhances their employability by formalising and documenting CPD activities. It assists in keeping knowledge up to date and illustrates an ability to adapt to changing roles in the food industry and food production environment. Ensuring currency in a complex job market can be difficult and companies look for staff who bring a broad range of skills.

What is a CPD program?

A continuing professional development program is an active self-planned and structured program for developing and enhancing your professional skills. Ideally, the program is designed with clear objectives, extends your professional knowledge and capabilities, and allows you to engage in a broad range of activities to increase your career options.

The AIFST CPD program

The AIFST CPD program was launched in 2019. It is voluntary and designed to encourage members to maintain currency of skills and knowledge and assist with career planning. It will provide recognition

of experience and interests and align food scientists with other well-respected professions.

Much of AIFST members' skill set is developed over their working life but is not always part of their formal qualifications. The CPD program is intended to provide recognition of these activities and skills by formalising and recording the process in a straightforward and transportable way.

The best outcome for the food science community is to develop a recognised professional identity. The competence of members is vital to the development and credibility of food science practitioners and AIFST is committed to providing value to members by developing and supporting this program.

How do I get involved?

Keep an eye out for member communications, visit the CPD page on the [AIFST website](#) or contact AIFST (education@aifst.com.au).





Alternative proteins and Australian Consumer Law

Words by Scott Bouvier and Lauren D'Ambrosio

Alternative proteins are a hot topic at the moment, whether it's cultured lab-grown meat or plant-based versions of traditional meat-based protein sources.

We're seeing rapid growth in the health and wellness foods segment, including plant-based foods which are increasing in popularity and appearing more frequently in supermarket aisles and fridges.

Fast food chains have also embraced the trend, with McDonald's Canada announcing the 'PLT' (plant, lettuce, tomato - using a Beyond Meat patty), KFC in the US producing 'Beyond Chicken' and Hungry Jacks in Australia partnering with CSIRO to develop plant-based products made

from legumes, including the 'Rebel Whopper'.

When selling these products to consumers, food businesses will need to consider the Australia New Zealand Food Standards Code (Code) and the Australian Consumer Law (ACL). But even if we assume these products comply with the specific requirements under the Code, we're still left asking the questions: 'what do we call these products?' and 'how do we make sure we're not misleading consumers when we sell them?'

One of the Australian Competition and Consumer Commission's (ACCC) priorities for 2020 is: "Misleading conduct in relation to the sale and promotion of food products, including

health and nutritional claims, credence claims and country of origin." In announcing the ACCC's priorities, ACCC Chair, Rod Sims, said there has long been an increased demand for the ACCC to take a more active role in preventing misleading representations or deceptive conduct in the marketing of food products.

"Honest and accurate claims about food products is important," Mr Sims said.

"When choosing which product to buy, consumers focus on claims about origin, manufacturing processes and nutritional representations. We are concerned some businesses either confuse consumers or deliberately make misleading claims to gain an

advantage in the market over suppliers who make honest claims about their products,” he said.

When assessing a misleading and deceptive conduct risk, it is critical to consider the overall impression created by food packaging. Even if the statements are literally true, the overall impression of the packaging (taking into account images and the presentation of the food product) may be misleading.

Similarly, even if the packaging fully complies with the Code, this is not a defence under the ACL. Food companies need to consider what the ordinary reasonable consumer would think of the representations made by the packaging, not just what their specialist food technologists, scientists or marketing experts would think and what impact the purchasing environment will have on these consumers.

In a busy supermarket, there is likely to be less detailed comparison occurring than in a furniture showroom where shoppers come in to buy one item. What about online shoppers - what impact does this have on the consumer’s ability to read and comprehend product claims and make purchasing decisions?

In the context of alternative proteins, imagine you are looking at the poultry fridge and there is a product which looks like crumbed chicken, packaged in a classic plastic-wrapped tray, displaying a prominent image of a chicken on the label, and featuring the descriptor ‘meaty’ and the name ‘chicken’, with ‘plant-based’ or ‘vegetarian’ in fine print.

What is the overall impression given by the presentation of that product? Could you have been misled into thinking it was chicken (of the clucking variety)? If you’re a savvy shopper, you may turn the label over and read the ingredients list to see ‘wheat protein’ or ‘yellow peas’ but would you understand what these ingredients are and the production methods involved? Would it make a difference if you had found this product in the specialty vegan fridge rather than mingled with the poultry? Would you expect this product to come up in the results of a search for ‘chicken’ at the online store?

The above is just an example, but there are many products similar to this currently on supermarket shelves. When it comes to alternative proteins, mimicking may be okay but misleading is not. Marketers need to carefully decide how to convey what these products taste like, while being clear that it is not in fact chicken (for example).

To manage the risks, food companies should increase the prominence of words like ‘vegan’ or ‘plant-based’, think critically about what key words will be tagged for online search terms, and work with retailers on supermarket positioning. Most importantly, always take a step back to put yourself in the position of the busy consumer and consider the overall impression.

Scott Bouvier and Lauren D’Ambrosio lead King & Wood Mallesons’ food law practice and advise a range of high profile food and consumer brands on food and advertising regulation, IP, technology, product recalls, therapeutic goods and commercial matters. 



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Baobab polysaccharides as a novel food ingredient

Words by Dr Vassilis Kontogiorgos

Baobab (*Adansonia digitata* L.), which belongs to the Malvaceae family, is an indigenous African tree widespread in arid savannah regions of Madagascar, mainland Africa, the Arabian peninsula, and Australia.

It includes eight species, six of which are endemic to Madagascar, which are easily recognised by their massive cylindrical or bottle-shaped trunks.

In Australia, baobab - commonly known as boab - belongs to the species *Adansonia gregorii*. It is the only species that is endemic to Australia, and is commonly found in the Kimberley region of Western Australia and western regions of the Northern Territory.

Both African and Aboriginal people have utilised baobab in many ways, as most parts of the tree (including the fruit, leaves, bark and seeds) may be used as food or for their medicinal properties.

Baobab has only recently attracted industrial interest after the European Union authorised baobab pulp as a novel food ingredient and as safe for human consumption under the decision 2008/575/EC of the European Parliament. However, the only part of the baobab tree used in Europe is the fruit pulp. The US Food and Drug Administration also approved baobab pulp as a food ingredient in 2009.

Uses and characteristics of baobab

Baobab fruit has an oblong or oval shape and consists of black seeds embedded in a white, chalky pulp. The baobab fruit pulp contains high levels of calcium and vitamin C. It is usually sold as a dry powder which, when dissolved in milk or water, can be used as a drink, sauce, substitute for cream-



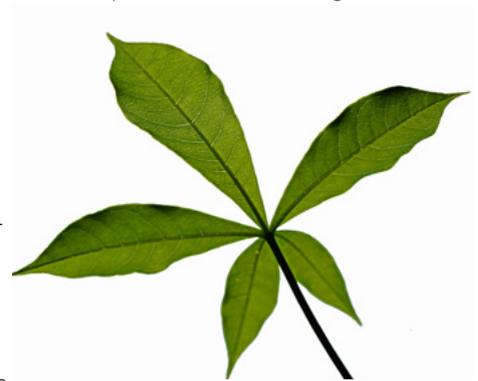
Baobab fruit showing the white pulp which is the edible part of the fruit. The Baobab leaf (below right) is a common staple in African cooking.

of-tartar in baking, or fermentation agent in brewing.

Because of the presence of saponins, sterols, and triterpenes, it has been traditionally used for pain relief as an analgesic, as an immunostimulant, as a pesticidal treatment and for anti-inflammatory purposes.

Baobab leaves are consumed in Africa, but not yet authorised as a novel food in Europe or the US. More specifically, baobab leaves are used in soup preparations and are a common staple in Africa due to the significant levels of minerals they contain, including iron, calcium, potassium, magnesium, zinc and phosphorus, and the presence of good quality proteins.

Young leaves are commonly used fresh and consumed as salad or as a



dried powder to prepare sauces. In Australia, the tap root of the seedling, known as 'baby boab', resembles a carrot and is commercially grown and sold as a gourmet food ingredient.

On an industrial scale, baobab fruit is now being explored in food and cosmetic formulations, and there are a few companies that process and trade baobab fruit products,

including in Australia. The functional properties of both the fruit and leaves is partly due to their viscosity enhancing characteristics which come from a group of polysaccharides.

In recent work at the University of Queensland, we have designed a protocol to obtain and characterise polysaccharides from baobab leaves and fruits. Generally, the amount of polysaccharide that can be obtained is higher in the fruit than in the leaves, but they provide different functional properties.

The distinguishing characteristic between the polysaccharides from the fruits and leaves is the size of the molecules, i.e. their molecular weight. In leaves, the polysaccharides are substantially larger, creating viscous solutions at low concentrations (-0.5-1 % w/v). These levels of use are on par with other well-established industrially-used thickeners such as guar or xanthan gums.

In contrast, fruit polysaccharides form viscous solutions at very high concentrations (>-10-20 % w/v). This is similar to Arabic gum that can be used at very high concentrations with minimal effect on viscosity, and is quite distinct from industrial applications such as flavour stabilisation in beverages.

However, baobab fruit and leaves present a distinct new source of polysaccharides to be exploited in the food, pharmaceutical and cosmetic industries. The advantage of this is that two distinct polysaccharides may be obtained from the same source simultaneously, making baobab unique.

Although most of this research has been carried out on African species, we can assume that many of the functional characteristics discovered are shared with the Australian boabs.

Potential importance of baobab trade

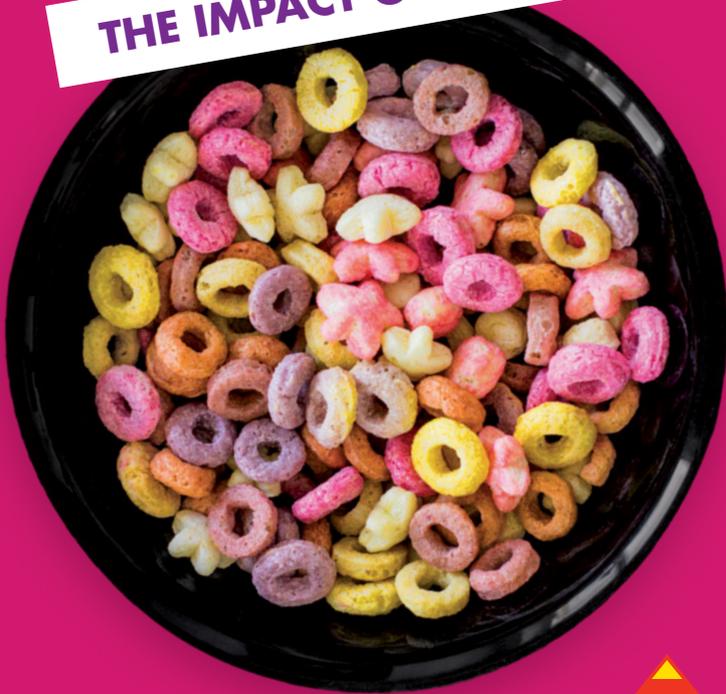
Smart and effective utilisation of indigenous agricultural resources is a key area through which local economies may grow, as there is a continuous need to increase the agricultural production.

The commercial exploitation of an indigenous crop, such as boab, will have an important impact on the local economy. This could contribute to sustainable economic growth and employment, improved agricultural productivity and a new income source for small scale food producers and rural or indigenous communities.

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Dr Vassilis Kontogiorgos is Senior Lecturer in food chemistry at the School of Agriculture and Food Sciences at University of Queensland. 



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Whole grain authenticity for Australian wheat

Words by Drs Daniel Skylas, Ian Wesley, Ken Quail and Hayfa Salman



The Australian Export Grains Innovation Centre (AEGIC) has developed a new method for estimating the authenticity of whole grain flour. This new model will help Australian flour mills communicate the benefits of whole grain products and increase consumer confidence, which will in turn drive consumption of healthy Australian whole grain products and increase value in Australian markets.

A new model

Whole grains are an excellent source of dietary fibre, providing essential vitamins, minerals and phytonutrients. Growing consumer awareness of the health benefits of whole grain consumption is driving growth in this market around the world.

Recently, the Whole Grain Initiative, a global consortium of food supply chain stakeholders, developed a

global definition of whole grain as a food ingredient.

The definition states: 'Whole grains shall consist of the intact, ground, cracked, flaked or otherwise processed kernel after the removal of inedible parts such as the hull and husk. All anatomical components, including the endosperm, germ, and bran must be present in the same relative proportions as in the intact kernel'.

The explanatory remarks accompanying the definition outline the inclusion of cereals and selected pseudo-cereals, wet and dry processing methods, recombination and reconstitution of millstreams and unavoidable losses in grain tissue from cleaning of grain for food safety purposes.

AEGIC recognised the importance of this definition and the likely impact on the domestic milling

industry. As a result, we set about developing a method for estimating the authenticity of whole grain flour milled from Australian wheat. Such authenticity will provide consistency for manufacturers and transparency for consumers.

As a first step, we surveyed major Australian mills to capture essential information to better understand whole grain milling practices in Australia. The survey also gave participants the opportunity to highlight their own specific issues or expectations surrounding the project. Survey participants expected the project to:

- Provide information on Australian wheat with less reliance on information reported overseas
- Provide recommendations for inclusion of bran and germ for making whole grain claims
- Develop a practical and robust

method to estimate authenticity of whole grain flour

- Help achieve consistency and transparency across the domestic milling industry
- Help increase consumer confidence and consumption of whole grain wheat products.

We then provided information to industry regarding variation in the nutritional composition of Australian wheat from two seasons (2017-18 and 2018-19) and made recommendations for the inclusion of bran and germ for making a whole grain claim, based on mass balance analysis of whole grain flour produced by major domestic mills.

Based on analysis of raw materials provided by mills, we developed a method to estimate the authenticity of whole grain flour milled from Australian wheat.

Estimating authenticity of whole grain wheat

Most whole grain wheat flour in Australia is produced by roller milling, in which the endosperm is gradually separated from the bran and germ, then later recombined at the mill or reconstituted off-site for food production. There is currently no accepted method or process to validate the correct recombination of millstreams so the major grain components (endosperm, bran, and germ) are present in typical natural ratios for wheat.

In developing the authenticity method, several factors were taken into consideration:

- *Applicability*

Any useful method to estimate authenticity of whole grain flour should be practical, robust, and relevant to common practices used by domestic mills. In particular, many mills combine bran and germ from roller milling into a single millstream, known as wheat grain concentrate (WGC), which is later recombined with straight-run (SR) bakers white flour to produce whole grain flour.

- *Variation in raw materials and millstreams*

Domestic mills source wheat

grades from different geographical regions that are blended to produce a commercial baker's grist for milling. Inherent differences in mill processes and set-up between mills leads to variation in composition of millstreams.

- *Relative grain proportions*

The general consensus is that 'authentic' whole grain wheat flour comprises 83 per cent endosperm, 14 per cent bran and three per cent germ. However, grain dissection studies reported in the literature indicate that these proportions can vary (Figure 1).¹⁻³ Relative grain proportions do not fully represent commercially milled flours, as completely clean separation of grain components is not possible.

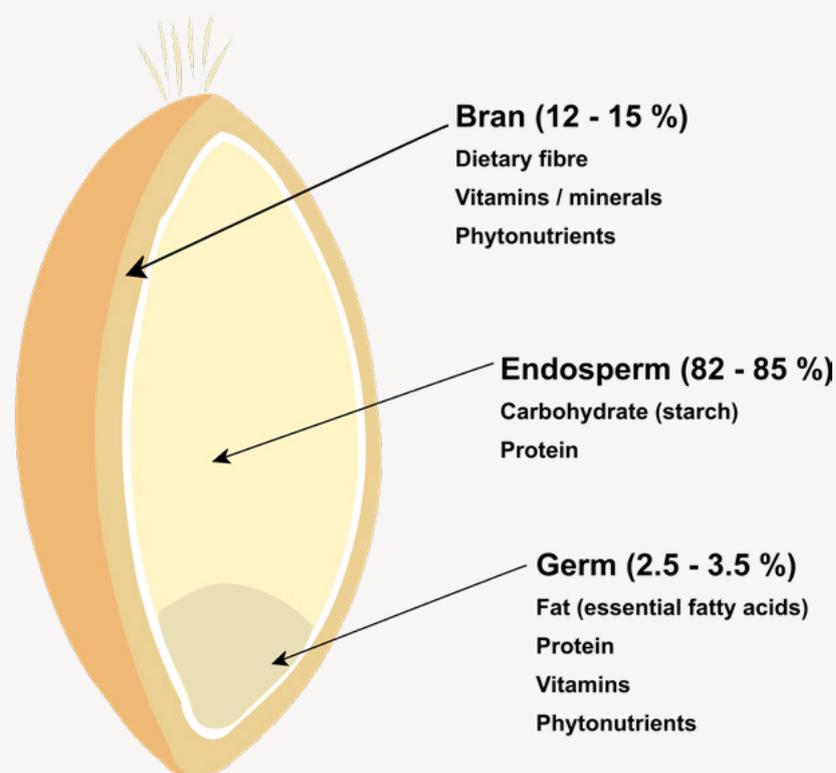
- *Statistical model*

We selected several nutritional parameters as markers for bran and germ components based

on differences in composition of millstreams provided by three major domestic mills. Parameters included protein, ash, fat, total dietary fibre (TDF), arabinoxylan and germ index.⁴ We analysed these in a series of blended flour samples containing specified ratios of SR flour and WGC. We prepared blended flours using millstreams that accounted for variation in raw materials produced in different regions, from two consecutive seasons, and different mill settings.

We used the resulting data to develop several statistical models for estimating authenticity of whole grain flour. Various single and multiple linear regression models were assessed for predicting the proportion of WGC (dependent variable) from a range of independent variables comprising protein, ash, fat, TDF, arabinoxylan and germ index.

Figure 1. Relative proportions and nutritional attributes of major wheat grain components.



The standard error of estimate and uncertainty for these independent variables using single regression were generally too high, but were lowest for ash. We carried out multiple linear regression using three independent variables comprising protein, germ index and TDF. The difference in performance for the ash only and multiple linear regression models was compared using a t-test, and found to be significant.⁵

In other words, the performance of the multiple linear regression model is much better than the single regression model. The p-values for protein, germ index and TDF are highly statistically significant ($p < 0.05$). TDF is the most significant contributor to the

performance of the model, followed by protein and germ index.

We assumed that the combined proportion of bran and germ (WGC) can range from 15 per cent to 20 per cent in whole grain wheat flour. This is based on relative grain proportions and ratios of millstreams demonstrated to be authentic whole grain flour from mass balance analysis. Therefore, whole grain flour is classified as authentic if the predicted WGC value (\pm uncertainty) is within the range of 15 per cent to 20 per cent (passes authenticity test). If the predicted WGC value (\pm uncertainty) falls outside this range, the flour is not classified as authentic (fails authenticity test).

Validation of authenticity model

We then analysed a range of flour products to test and validate the authenticity model. The first set of samples consisted of eight commercial flour products of unknown composition supplied by a major domestic mill (Table 1).

Blind testing of these samples resulted in six flour products being classified as authentic whole grain wheat flour. When reported, the mill confirmed that the results met their expectations. The two flour products that failed the authenticity test were manually prepared by the mill and were not considered to be whole grain.

This demonstrated the first

Sample	Protein (%)	Germ index (Abs 385 nm)	TDF (%)	Authenticity
1	11.6	0.103	8.5	FAIL
2	11.2	0.124	9.2	PASS
3	13.7	0.100	10.1	PASS
4	13.5	0.115	8.9	PASS
5	16.0	0.119	8.3	FAIL
6	15.1	0.100	7.6	PASS
7	14.0	0.104	8.8	PASS
8	12.6	0.134	8.3	PASS

Table 1. Estimated authenticity of whole grain flour products provided by a major domestic mill.

Sample	Product description (Packet label)	Protein (%)	Germ index (Abs)	TDF (%)	Authenticity (Pass / Fail)
A	STONEGROUND WHOLEWHEAT BAKERS FLOUR	12.5	0.10	10.3	PASS
B	WHOLEMEAL PLAIN FLOUR	11.0	0.10	9.2	FAIL
C	WHOLEMEAL PLAIN FLOUR	11.3	0.10	8.7	FAIL
D	ORGANIC STONEGROUND WHOLEGRAIN FLOUR	11.0	0.12	12.4	PASS
E	WHOLEMEAL PLAIN FLOUR	13.1	0.10	8.5	PASS
F	LOW PROTEIN WHEAT (APW)	9.8	0.16	11.7	PASS
G	LOW PROTEIN WHEAT (ASW)	8.8	0.16	11.9	PASS

Table 2. Estimated authenticity of supermarket flour products and low protein wheats.

successful application of AEGIC's model for estimating authenticity of whole grain flours produced by a major domestic mill.

The second set of samples consisted of various flour products purchased from a supermarket, including two low protein wheats which were impact-milled (single millstream) to whole grain flour. These samples were analysed for moisture, protein, germ index and TDF and authenticity was estimated using the model (Table 2).

Samples A, D, E, F and G are classified as authentic whole grain wheat as predicted WGC values (\pm uncertainty) are within the 15 per cent to 20 per cent range. Samples B and C are not classified as authentic whole grain wheat as predicted WGC values (\pm uncertainty) are < 15 per cent.

Confidence in whole grain claims

AEGIC's whole grain authenticity model was developed using Australian

wheat milled by our major mills. The model incorporates natural variation in raw materials, different mill settings used by the mills and relative wheat grain proportions that are well established in the literature.

Promotion of AEGIC's whole grain wheat authenticity method to the wider industry will help mills in making whole grain claims and help achieve consistency, compliance, and transparency across the domestic milling industry. This information will also prove useful when working with international millers using Australian wheat for whole grain products.

For more information visit www.wholegraininitiative.org/en/

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About AEGIC

AEGIC aims to be Australia's leading organisation for market insight, innovation and applied technology in the grains industry. AEGIC's whole grain authenticity project was carried out by Dr Daniel Skylas, senior research scientist, Dr Ian Wesley, principle research scientist and quality manager, Dr Ken Quail, general manager - research and technical services (Sydney) and Dr Hayfa Salman, business manager - analytical laboratory (Sydney). ①



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Post-Pandemic Impacts: How the Food System Will Adapt

BY KELLY HENSEL

How the food system will adapt and shift as a result of the COVID-19 pandemic isn't yet fully known, but experts agree that the scope of change will be significant.

It's often said that change is constant, and that has perhaps never been more true than during the ongoing global coronavirus crisis, where health and economic news has changed on an hourly basis. How the food system will adapt and shift as result of the COVID-19 pandemic isn't yet fully known, of course, but experts agree that the scope of change will be significant. Industry experts shared some predictions with *Food Technology*.

Foodservice Trends Will Accelerate

It's often said that change is constant, and that has perhaps never been more true than during the ongoing global coronavirus crisis. Pre-pandemic, chains had already started to implement digital ordering platforms to ramp up takeout and delivery sales. Amid the pandemic, restaurants that hadn't considered taking the leap into digital ordering are seeing it as a way to keep their businesses afloat with dine-in off the table.



New restaurant models will emerge post-pandemic, predicts The NPD Group's David Portalatin. Photo courtesy of The NPD Group

"The pandemic is causing many existing trends in the restaurant industry to accelerate," says Scott Landers, who runs food delivery consulting group Figure 8 Logistics.

"In 2019, digital orders—either on a smartphone or a website—for delivery grew by 16% and digital orders for takeout grew by 33%," says David Portalatin, vice president, industry advisor – food, The NPD Group. "I think that what you'll see is those companies that were already winning with those kinds of consumer offerings probably come out of this a little stronger than some of their peers."

Delivery has become as important as takeout, if not more important, as consumers shelter at home and avoid public places like grocery stores and restaurants. According to Portalatin, only 3.4% of all restaurant orders were for delivery prior to the pandemic. That has changed dramatically and is unlikely to go away after the pandemic is over. "Delivery will be more important than ever—both to the restaurant and to the diner," predicts Landers.

More Respect for Processed Food?

For food manufacturers, the impact of the pandemic could be felt almost immediately. As consumers rushed to stockpile food and beverages for a lockdown scenario, they were reaching for many of the same types of food. While only months ago, many were shunning processed and packaged foods in favor of fresh and organic, in March, they began buying canned goods, frozen vegetables, and macaroni and cheese. Stocks soared for some of the giant consumer packaged goods (CPG) companies that had been experiencing lagging sales for years. While the end of the pandemic is not yet upon us, many experts have begun forecasting what is in store for food companies in the year ahead.

Kelly Hensel is senior digital editor of Food Technology magazine (khensel@ift.org)

This is an excerpt from the article "Post-Pandemic Impacts: How the Food System Will Adapt," which appeared in the May issue of Food Technology magazine.

Read the complete article at ift.org/postpandemic



Food Disruptors Podcast

Consumer behaviors in the time of Covid 19: Food Service

The COVID-19 pandemic continues to pull the global food system into new and uncertain territory. Hear from experts on consumer behavior and insights, including ideas on consumer behavior in relation to COVID-19, and projections on how these trends will evolve.

Listen in at ift.org/foodservice

FOOD FILES

Words by Drs Russell Keast and Gie Liem



VR in times of COVID-19

While in isolation due to COVID-19, we have been consuming the majority of our meals and snacks in our own home environment. Several studies in the past have shown that the environment in which we consume our food can have a direct influence on how much we like and desire certain foods.

Disorganised and/or depressing environments, such as a rainy day, have the potential to increase our urge to consume unhealthy snack foods. On the other hand, positive environments

such as a sunny day, may increase our desire for healthy foods.

While staying home due to the COVID-19 lockdown, we are mostly eating our food inside, which may not be optimal for healthy food consumption. However, it may be possible that virtual can offer a solution. Could we immerse ourselves in a virtual positive environment in such a way that drives healthier food choices?

In the June edition of Food Quality and Preference, a Finnish research group will present a study

which investigates whether positive immersive environments can increase one's liking and desire for healthy foods. For the study, 67 young to middle aged participants were immersed in two virtual environments, and a control condition, by means of projection of a movie in a cave style set up.

One virtual environment showed a sunny day picnic, whereas the other showed a sudden rain shower during a picnic. In the control condition, the screens in the cave were left blank. In each condition participants were presented with a healthy (rye nachos) and an unhealthy (milk chocolate) food and were asked how much they wanted and liked the food. In addition to these explicit measures, EEGs were recorded as a representation of brain activity. Activity in certain areas of the brain is often used as a proxy of cognitive load which is induced by a stimulus.

The results suggest that in the control condition the unhealthy snack was liked and wanted more than the healthy snack, before participants actually tasted the food. Yet, when immersed in the sunny positive environment, participants' liking and wanting for the healthy snack (pre-tasting) was increased to the level of liking and wanting of the unhealthy snack. This suggests that the positive environment was able to increase liking and wanting of healthy snacks before tasting.

Interestingly, the immersive environments did not influence the liking and wanting of the food after participants actually tasted the food. EEGs showed higher brain activity in the frontal, parietal and occipital areas of the brain when confronted with the healthy food than with the unhealthy food.

This suggests that participants put more effort into assessing and judging the healthy food than the unhealthy food, which made them less susceptible to the influence of the environment. When tasting the healthy food, the actual sensory perception of the food might have 'overruled' the effect of the environment.

In conclusion, a positive immersive environment might have a larger influence on choosing a healthy food rather than influencing the sensory evaluation of a healthy food. While being isolated from a diverse range of positive environments, immersive technology might be one way to choose your way into healthier food options.

Kyösti Pennanena K., *et al.* (2020). "Effect of virtual eating environment on consumers' evaluations of healthy and unhealthy snacks." *Food Quality and Preference* 82.

Perception of oil and fat in foods

Fat is a source of high-dense calories and essential fatty acids, and is required for the digestion of fat-soluble vitamins. Moreover, fat can modify flavour and increase the palatability of a meal.

To reduce fat content in foods, the question of which dietary fat attribute might be dominant in perception needs to be addressed. Depending on the product (solid or liquid) and its typical fat content, the senses of vision, olfaction, taste and touch differ in their impact on fat discrimination. The addition of flavours to compensate for the sensory gap caused by fat reduction, or to increase the perceived creaminess without changing the caloric content, may mask differences in fat concentrations.

It is important to note there will be individuals who can detect small changes in fat content, and others who may not identify large differences in fat content. Heinz *et al* found that participants who were sensitive to low concentration of free fatty acid components in oils are more likely to detect low concentrations of TAG-rich fats, indicating a role for taste in detection of fats and oils.

Further to this, new research by Glumac and Chen attempted to quantify the proportion of smell, taste and touch when assessing oil and fats. The study was small, involving 30 untrained participants who completed one session.

There were five dimensions tested including:

1. Finger tactile
2. Aroma
3. Taste
4. Taste and tactile
5. Taste, tactile and aroma.

They evaluated six samples including oil, fat, and fatty acids. The authors concluded that texture and aroma were the dominant modalities, with multimodal perception also playing a role in fat perception. Taste itself was a minor component. The implications of the research are related to fat reduction and the need to compensate texture and aroma when reducing the fat and oil levels.

However, the authors did not take into account the post-swallow influences of fat through the alimentary canal, limiting the research to the oral cavity only. There is potential that the taste influence of fats and oils may be more important post-swallow, as detailed in the Heinz *et al* paper.

Heinz *et al.* (2017). "Oil perception. Detection thresholds for varying fatty stimuli and individual differences." *Chemical Senses* 42(7) pp 585-592.

Consumer and sensory testing in CASS during COVID-19 lockdowns

On March 12, the Centre for Advanced Sensory Science (CASS) Food Research Centre made the decision to stop all sensory and consumer testing in the CASS labs. At that stage there were disturbing COVID-19 trends internationally and growing problems locally. Our staff, descriptive panels, and consumers were increasingly worried with the close person-to-person nature of testing procedures, so we took the necessary step to stop all testing in CASS labs.

The closure created problems for our ongoing work with our food industry, time-dependent projects, our PhD students with data collection on hold, and our casual workforce having limited hours while we remain closed. While the closure created many problems, it also offers the opportunity to work differently.

The people that make up our Descriptive Analysis panel were effectively 'on holiday' until we could

safely start up lab testing again. But with the use of platforms such as Zoom and Compusense data collection, we are able to maintain training with the panel in their homes, using common household items.

We also completed urgent descriptive analysis and other consumer testing 'in home', using Zoom, and Compusense and by home delivery of items to be evaluated. The same has occurred for our lab-based consumer testing - we have now offered consumer testing 'in home', using the same platforms. So, while the core business of the sensory and consumer labs has changed, it has also provided opportunities to extend our testing capabilities.

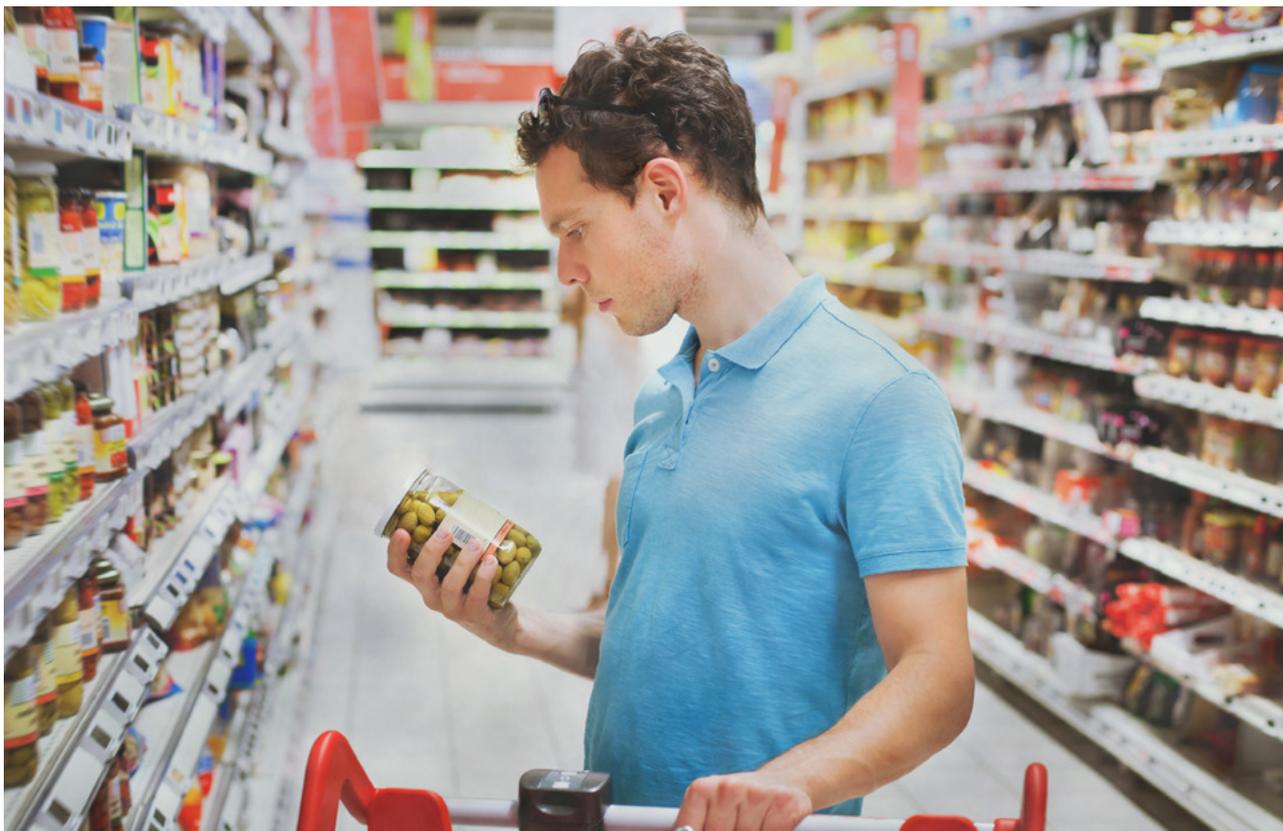
We are looking forward to restarting our normal lab work, however, this will look and feel different until a vaccine for COVID-19 is developed. We will employ a full range of safety procedures and physical distancing measures, doing whatever it takes to continue our business while not putting any staff or customers at risk.

We ask all staff and panellists to download the Covid Safe App so we have some measure of notice if any staff, panellists or consumers have been in contact with an infected individual. We will run labs at half capacity to ensure physical distancing between staff, panellists and consumers. We will be using hand sanitisers for all participants (we already did for staff). Our staff will wear face masks. Cleanliness in the labs has always been a priority, it is only further reinforced by COVID-19.

Like everyone else, we look forward to emerging from this pandemic refreshed, with new ideas, and looking forward to exciting times ahead.

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Dr Russell Keast is Professor and Dr Gie Liem is Associate Professor at the CASS Food Research Centre at Deakin University. 



Regulating food – set information standards or transparency?

Words by Scott Bouvier and Lauren D'Ambrosio

Food regulations should be agile, flexible and embrace innovation, while providing a system which maintains the integrity of premium claims.

The standards behind innovative premium claims should be determined by market forces and consumer preferences, and not by a levelling common denominator. Innovation is to be encouraged while balancing safety concerns and consumer protection.

Process and provenance claims focus on the journey the food has undertaken or the origin of that food. They can be notoriously difficult to test and there may be different opinions on the underlying standards. One business may start promoting a claim at a certain standard and then be met with a competitor which

uses the same claim at a much lower standard and with a lower level of investment.

In some cases, such as in the organic industry, there are certifying bodies which provide additional confidence regarding an organic claim, but they are not mandatory. In other cases, such as the meat industry, there are industry definitions for claims such as 'grass-fed', but they may not necessarily accord with consumer expectations. In many other cases there are no standards or clarity, for example, when it comes to labelling foods 'natural' or 'superfood'.

Consumers are unlikely to have a high degree of understanding of the background to these claims and often simply accept them at face value. Given the multiple misleading claims

resulting in prosecutions in the free range egg industry, the Australian Competition and Consumer Commission (ACCC) drew together a national information standard which defined the meaning of free range eggs.

Even leaving aside the challenge of defining the multitude of process and provenance claims, we must ask whether establishing a set information standard is the best way to encourage innovation and additional investment?

With free range eggs, it appears there is no advertising incentive to reduce the stocking density below the permitted 10,000 hens per hectare. Therefore, in response to the ACCC's definition of free range eggs, we expect some producers may have actually increased their stocking

density to be cost competitive.

With set information standards, there is a risk of reducing competition and creating a lower, but more level playing field amongst competitors.

Country of origin labelling laws are another example of an information standard-like regulation which is very specific but fails to provide key information which is important to consumers. Food businesses wanting to use 'Made in Australia' claims are required to use the kangaroo graphic, together with a ruler and percentage claim, with no requirement to disclose the origin of the non-Australian ingredients.

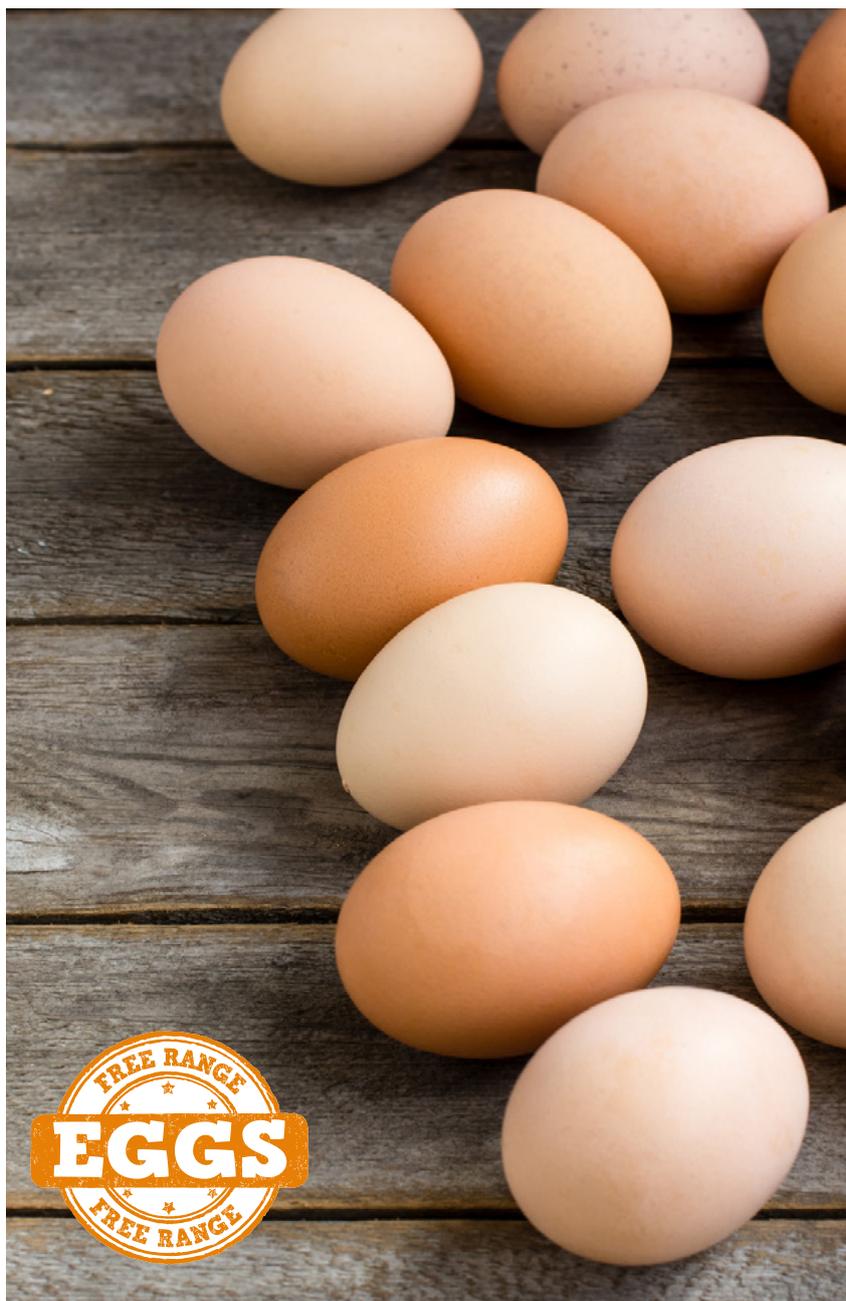
Leaving aside many Australians' ability to properly understand the percentage claim, consumers are not aware of the nature of the ingredients which come from Australia.

For example, bacon might be labelled as having 15 per cent Australian ingredients, but that 15 per cent could be as meagre as water, salt, sugar and smoke. With honey, consumers may be aware that up to 60 per cent of the honey is from overseas, but not whether that honey comes from China, Argentina, the United States or other markets.

The major issue with process and provenance claims is that they are usually undefined and different people can hold genuinely different views about the appropriate qualifications to support the claim. While it is usually not possible to define those standards on pack, claims could be put to greater scrutiny if there was mandatory transparency about the methodology and information which supported that claim.

With the ubiquitous nature of smart phones and the ability to scan barcodes or QR codes, for example, we should be moving beyond the label and requiring the supporting information and methodology to be made available online. While this is already done by many businesses on a voluntary basis, it should be a mandatory requirement.

For example, if a business makes a representation as to the process



they followed or the provenance of a particular food, they should be obliged to take reasonable steps to communicate an explanation of the details which support that claim.

Using this approach, consumers can understand and, if necessary, test the substance of these claims and compare them with other competitors in the market. This should provide businesses with the flexibility to innovate with process and provenance claims, provided that they are able to substantiate those claims and have them scrutinised.

While many consumers may

not look at the information, other consumers as well as retailers, consumer groups, competitors and the ACCC will put those claims under scrutiny and challenge them if the information does not justify the claim.

Scott Bouvier and Lauren D'Ambrosio lead King & Wood Mallesons' food law practice and advise a range of high-profile food and consumer brands on food and advertising regulation, IP, technology, product recalls, therapeutic goods and commercial matters. ⓘ



Australian macadamias meeting sustainability demands

Words by Lynne Ziehlke

Australian macadamia growers are using scientific research to understand the inherently sustainable characteristics of the macadamia tree and guide the adoption of sustainable on-farm practices to meet the demands of today's so called 'conscious consumer'.

Forbes reported last year that one third of consumers passed on their favourite brands due to sustainability considerations¹ and 83 per cent of consumers in APAC nations expect companies to care about the environment.²

In Australia, it's reported that 55 per cent of consumers qualify as 'conscious consumers',³ and the Australian macadamia industry is embracing the opportunity this presents.

Lynne Ziehlke, general manager, marketing for the Australian macadamia industry, noted demand for transparency is at an all-time high and sustainable production is a non-negotiable for many.

"Now and in the future, selecting ingredients that have resilience to production pressures, and therefore reduced environmental impacts, will be increasingly desirable to both producers and consumers," Ms Ziehlke said.

"Manufacturers already understand the taste, texture, luxury and health that macadamias can bring to a product, and we're excited to share the sustainability credentials macadamias can now deliver too.

"From water use efficiency to carbon sequestration, minimisation

of carbon outputs, recycling of by-products and world's best biological control, the macadamia industry really is kicking goals in this space," she said.

Research backs inherent sustainability

The macadamia tree is a sustainability giant of the plant world, thanks to its inherent ability to optimise water use and sequester carbon from the atmosphere.

Recent scientific analysis of sap flow data from macadamia orchards in Queensland shows macadamia trees rationalise available water more efficiently than previously estimated. This is due to the tree's clever internal water management system that shuts down its stomatal pores during times of low moisture, making the tree



resilient to environmental factors such as drought.⁴

So, while changes in the external environment can significantly stress other crops causing inconsistent yields and supply chain disruption, the macadamia tree has a natural ability to weather volatile conditions.

These findings pave the way for growers to adopt smarter, more efficient irrigation schedules and water management that minimise the need for excessive intervention.

In separate research findings,⁵ it has also been discovered that the average Australian macadamia orchard removes more than 17 tonnes gross and 14.5 tonnes net of carbon per hectare per year from the atmosphere. The macadamia tree's size, volume of foliage and long lifespan mean

that every tree can hold a substantial amount of carbon.

Australian growers minimise carbon footprint

Australia's 800-odd macadamia growers are determined to tread as lightly in the orchard as possible. Ms Ziehlke said this is because as well as absorbing carbon, Australia's macadamia industry limits its carbon output by minimising the use of heavy diesel-consuming machinery and transportation.

Human intervention in the orchard is light, and processing facilities are located within major growing regions, ensuring the nuts don't have to travel far from the tree to be shelled, dried and packed.

Growers ensure every part of the macadamia tree and nut is either reused or recycled, with nothing going to landfill. Macadamia shells are used to generate electricity or made into stock feed, and any organic matter, such as branches and foliage, are composted beneath the tree and reabsorbed by the soil from which they originally grew.

Working with nature

The industry works with nature wherever possible, as demonstrated by the extensive implementation of 'pest suppressive landscapes'. This is a practice that centres on increasing biodiversity to bring balance to the natural environment and allow beneficial insects that suppress harmful pests to thrive.

It is achieved by planting diverse species around the macadamia trees and actively sowing inter-rows between tree rows with a host of different vegetation including grasses, legumes and brassicas, as well as floral coverage to encourage natural pollinators.⁶

Ms Ziehlke said Australia's macadamia industry sees no trade-off between sustainable growing practices and productivity.

"We know without a doubt that the more sustainable we are, the more productive we are, and this is driving innovative thinking on-farm, increased

biodiversity, and development of effective biological controls," Ms Ziehlke said.

"The Australian macadamia industry has a long history of combating pests and disease through the use of biological controls, with the best-known initiative being the introduction of the *Trichogramma* wasp as a natural and highly effective tool in the fight against nut borer.

"Australia is also at the forefront of another big development in biological control, with trials of entomopathogenic fungi as a natural pest control due for completion soon.⁷ Researchers have isolated the most effective fungi and we're conducting trials in orchard to determine the best time of the season to use them," she said.

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About Australian Macadamias

Australia is the world's major producer of macadamia kernel and macadamias are Australia's fourth largest horticultural export. There are approximately 800 growers producing more than 45,000 tonnes per year, with 70 per cent of the crop exported to more than 40 countries.

Lynne Ziehlke is general manager, marketing, for the Australian macadamia industry. 



Food research roundup - ARC Linkage Projects

Words by Dr Martin Palmer

The Australian Research Council's (ARC) Linkage Projects scheme supports the development of long-term strategic research alliances between higher education organisations and industry and other research end-users.

Such linkages apply advanced knowledge to problems, provide opportunities to run internationally competitive research projects in collaboration with organisations outside the higher education sector, and enhance the scale and focus of research in Australian Government priority areas.

Linkage projects are now well established as a valuable part of Australia's food research landscape. The scheme provides project funding of \$50,000 to \$300,000 per year for up to five years, and projects are commonly built around a lead university in collaboration with one or more industry partners.

The newly-funded linkage projects announced recently by ARC, due to commence in 2020, include the following collaborations within the broad 'food' category (extracted from the ARC website):

Intelligent bioprocessing for next-generation nutritional yeast extracts

Led by Associate Professor Greg Martin, University of Melbourne, with Bega Cheese Limited. This project aims to provide new, science-based levers for optimising the industrial production

of tailor-made yeast extracts for food applications. Advanced biochemical and engineering methods will be used to develop new knowledge of the links between yeast growth conditions, cell biochemistry, processing and the flavour and texture profiles of yeast hydrolysates. This understanding will allow the properties of yeast hydrolysates to be accurately tuned during yeast production and processing. The resulting process improvements and innovations will increase the efficiency and quality of current yeast extract products and allow the development of new food products.

Engineering cyanobacteria for high-value flavours and fragrances production

Led by Dr Esteban Marcellin, University of Queensland, with Bondi Bioworks Pty Ltd. Engineering the metabolism of cyanobacteria for industrial production of flavours and fragrances has great commercial potential. Cyanobacteria capture more than 25 per cent of the planet's carbon. Due to their native metabolism and capacity to express complex plant proteins, they represent an attractive synthetic biology platform for the biosynthesis of flavours and fragrances. Combining physiological strain characterisation and 'omics' studies, new synthetic biology strategies and models will be developed. The project aims at engineering a suite

of modified freshwater and marine cyanobacteria for biosynthesis of flavours and fragrances, enabling solar biomanufacturing to underpin the emergence of an advanced Australian bioeconomy.

Maximising pineapple production for Australian farmers using genome editing

Led by Professor Jose Botella, University of Queensland, with Tropical Pines Pty Ltd. This project addresses the single biggest issue affecting the viability of pineapple farming in Australia and internationally: premature flowering leading to supply collapse. We aim to develop CRISPR technology to breed new pineapple varieties using non-GM approaches. Expected outcomes include the production of pineapples with resistance to premature flowering, as well as the technologies to deliver additional improvements in the future. The new varieties will benefit farmers through increased production, maximising supply capability for a rapidly growing internal demand. This will benefit Australian pineapple producers through higher profitability in existing markets, as well as enabling expansion into international markets.

Incorporation of legume protein in liquid breakfast for a healthy Australia

Led by Professor Stefan Kasapis, RMIT University, with Sanitarium Health & Wellbeing Company.

This project aims to understand and control the properties and interactions of legume protein with other ingredients (for example, whey protein and dietary fibre) to formulate healthy liquid foods with superior techno-functionality. This research should significantly broaden our understanding of the behaviour of legume protein-phospholipid complexes and their contribution to malodorous flavour development. The expected outcomes are protocols to prevent undesirable sensory characteristics in liquid foods. This should benefit the food industry by improving the sensory attributes of beverages enriched with legume protein, leading to the creation of novel, highly nutritious products with superior sensory attributes and long shelf-life.

Design a targeted delivery system for probiotics

Led by Professor Fariba Dehghani, University of Sydney, with Pharma-Care Laboratories Pty Ltd. This project aims to improve the effectiveness of probiotics by developing a targeted delivery system to the colon. This interdisciplinary research will generate new knowledge in the field of microbiota and develop new delivery systems for live microorganisms and other active compounds. Expected outcomes include increased understanding of the factors affecting the viability of probiotics during storage and passage through the gastro-intestinal tract, the establishment of probiotics into gut flora, and how this incorporation affects the dynamics of gut microbiota. The new technology can be utilised across a wide range of therapeutics that target the colon to promote the well-being of our society through commercialisation by industry partners.

Resolving the genetics of grain pigmentation traits in rice

Led by Associate Professor Tobias Kretschmar, Southern Cross University, with Natural Rice Co. Pty Ltd. New critical knowledge will enable future breeding of quality black rice

cultivars that can exploit the high UV Australian growing environment to enable domestic production of high-value, healthy black rice. The demand for functional foods with health benefits, including black rice, is increasing both domestically and internationally. The concentration of key functional compounds in black rice may be increased by growing optimised cultivars under high-UV radiation, making Australia well placed to produce the highest quality black rice. Utilising a unique genetic resource, this project will resolve how the interaction between crop genetics and the growing environment drives the concentration of functional compounds in black rice.

Geographical indications for wine in Australia's free trade agreements

Led by Professor Mark Davison, Monash University, with Australian Grape and Wine Incorporated. This project aims to clarify the appropriate basis for protecting geographical indications for wines in trade agreements and domestic legal systems. The project expects to generate new knowledge concerning the criteria, evidence and procedure that should be required to establish a geographical indication. Existing law risks misuse of this mechanism to unjustifiably protect domestic markets, and the European Union is seeking protection for what appears to be grape varieties rather than geographical indications. Expected outcomes include evidence-based recommendations to government and industry which should benefit Australian economic interests by enhancing our ability to resist spurious geographical indication claims.

Purification and bioactivity of legume protein as nutritional supplements

Led by Associate Professor Stuart Johnson, Curtin University, with The Glycemic Lupin Company Pty Ltd. Lupin is a major Australian high protein legume crop, but is undervalued at only ~\$200 per tonne due to its use as an animal feed. This project aims to add value to the crop by



Blue-flowered, narrow-leaf lupin (Lupinus angustifolius)

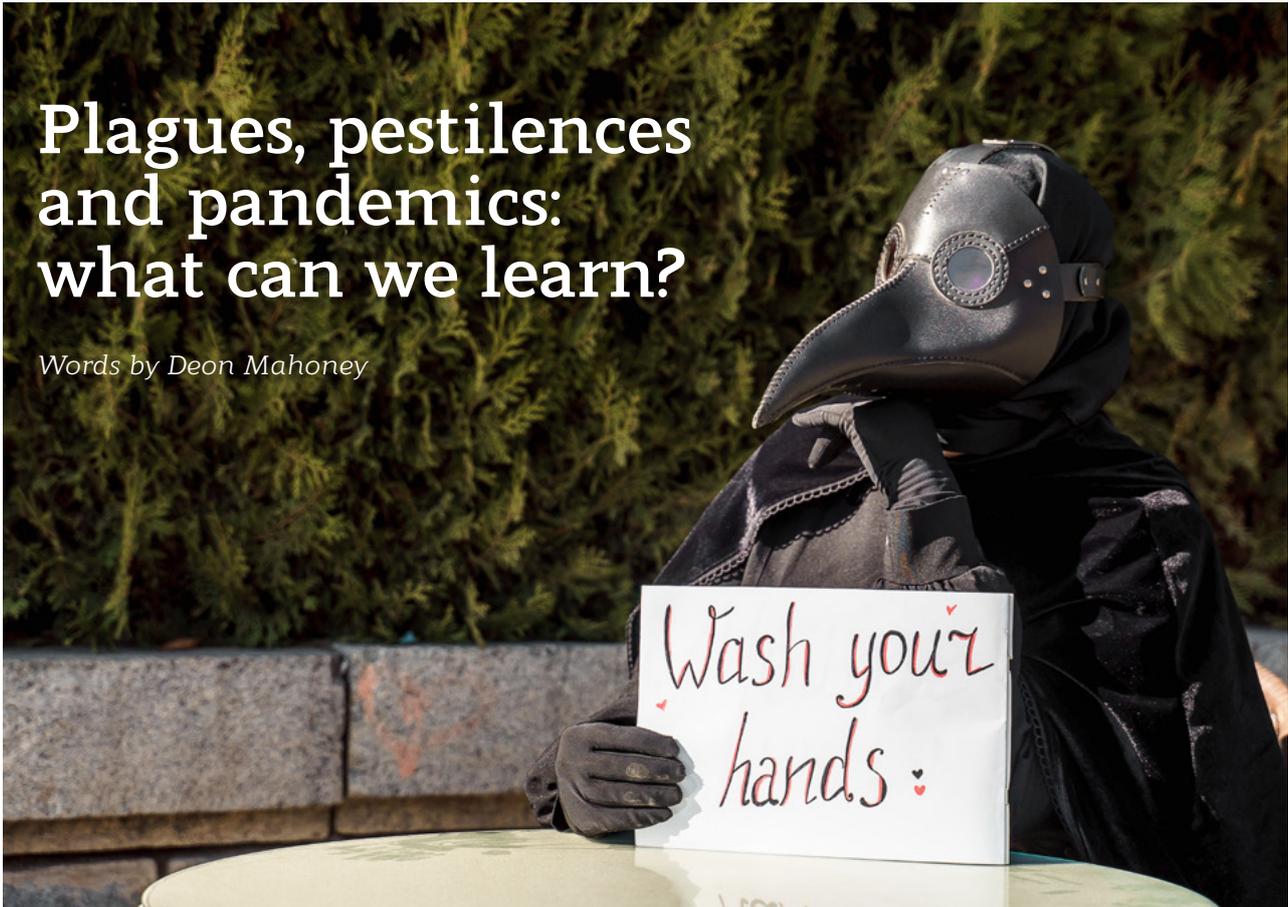
designing a scalable food-grade and commercialisable technology to purify the protein, gamma-conglutin, from lupin seed waste as a nutraceutical for human blood glucose control. The process optimisation and mechanism of action for gamma-conglutin will be informed by proteomic analysis and cellular studies. The project will benefit farmers by adding a premium to their crop value. A new gamma-conglutin purification technology will also be available for processors to commercialise, giving consumers a natural product to help their blood glucose control.

These eight projects represent total ARC cash funding of more than \$3.3 million for the lifetime of these research projects. More detail on these and other ARC-funded projects can be found on the ARC website (www.arc.gov.au), including a searchable database for all new, current and completed research.

Dr Martin Palmer is Enterprise Fellow, Food and Agribusiness, at University of Melbourne. ⓘ

Plagues, pestilences and pandemics: what can we learn?

Words by Deon Mahoney



With the COVID-19 pandemic we find ourselves living through an extraordinary crisis with significant public health, economic and social disruption and uncertainty. Not surprisingly, we face questions such as: *How long will this pandemic last? When will we find a vaccine or an effective treatment? How will life return to normal?*

Historically, pandemics have raised public anxiety with citizens resulting in the adoption of measures ranging from avoidance to abandoning the custom of shaking hands, fleeing cities, wearing camphor bags around the neck and washing coins in vinegar. Despite a lack of scientific evidence at the time, some strategies were effective.

Past epidemics of infectious disease can teach us how to deal with SARS-CoV-2 coronavirus and inform our approach to managing the human health impact. They may also inform measures that ensure the reliability and safety of our food supply.

The forgotten pandemics

Pandemics have been a feature of society since Roman times. Diseases such as the Antonine plague in the time of Marcus Aurelius, the black death, smallpox, yellow fever and the 1918 flu have all led to death and widespread suffering in the past.

Whilst it isn't an everyday fact, we are currently living through the seventh global cholera pandemic. Commencing in 1961, it is the world's longest running pandemic. Cholera is a global threat to public health and, if left untreated, can be fatal within hours. It is endemic in more than 47 countries and sickens around 2.9 million people, causing 95,000 deaths annually.¹

Cholera is caused by the bacterium *Vibrio cholerae* which causes an acute diarrhoeal disease following ingestion of contaminated food or water. Its prevention and control require a combination of water sanitation, food hygiene, health education, disease surveillance, vaccination and treatment of existing cases. Promotion of simple hygiene practices, such as proper

handwashing with soap and the safe preparation and storage of food, are critical to managing the risk.

The battle to end the forgotten pandemic has seen the World Health Organisation operationalise a new global strategy called *Ending Cholera—A Global Roadmap to 2030* which provides a path toward a world in which cholera is no longer a threat to public health.²

The pillars of that strategy are multi-sectoral and include infection surveillance and reporting, strengthening the health care system, improved sanitation and hygiene, vaccination, increased community engagement and the provision of leadership and coordination. All of which represent a blueprint for addressing the COVID-19 pandemic.

The role of handwashing

During the COVID-19 pandemic there has been a huge emphasis on the importance of proper handwashing. There has been a spike in the use of hand sanitisers and various memes

Date	Name	Organism	Deaths (estimates)
165-180	Antonine plague	Possibly smallpox or measles	5 million
541-542	Plague of Justinian	<i>Yersinia pestis</i>	30-50 million
1347-1352	Black death	<i>Yersinia pestis</i>	75-200 million
1520-unknown	New World smallpox	<i>Variola major</i> virus	25-55 million
1817-1923	Cholera pandemics (1-6)	<i>Vibrio cholerae</i>	>1 million
1855-1959	The third plague	<i>Yersinia pestis</i>	12 million
1889-1890	Russian flu	Influenza virus H2N2	1 million
1918-1920	1918 flu	Influenza virus H1N1	40-50 million
1956-1958	Asian flu	Influenza virus H2N2	2 million
1968-1970	Hong Kong flu	Influenza virus H3N2	1 million
1981-present	HIV/AIDS	Human immunodeficiency virus	35 million
2019-present	COVID-19	SARS-CoV-2 coronavirus	500,000 (June 2020)

Table 1: Major plagues and pandemics

and jingles promoting handwashing. There is even a website which generates handwashing posters with the lyrics of your favourite song – www.washyourlyrics.com/.

The importance of handwashing was first recognised by the Hungarian physician Ignaz Semmelweis who proposed the need for hand hygiene in medical settings. He made the connection between dirty hands and deadly infection and demonstrated that the simple act of handwashing was a critical way to prevent the spread of germs in an obstetrics ward in Vienna in the 19th century.

Even today, the benefits of handwashing in preventing the transmission of disease, as well as reducing the incidence of foodborne illness, are widely underestimated and poorly practised. Much has been written about the topic of handwashing as a critical action to prevent foodborne illness transmission by mitigating cross-contamination between hands, surfaces and foods.

Perhaps one of the benefits that will accrue from this pandemic is greater appreciation of the need to wash hands properly in food processing and preparation settings which will most likely result in a concomitant decrease in foodborne illness.

Isolation and physical distancing

The Great Plague was a major calamity in London from 1665-1666, with more than 100,000 deaths. The poor were mainly affected, as the elite and wealthy fled the city and watchmen were sent to guard over infected households. It was a time when medical solutions were limited, but the profession started to take an interest in evidence-based science and experimented with sterilisation, quarantine and isolation, as well as physical distancing.

The College of Physicians focussed on prevention and published policies for personal and public protection. These policies including the practice of quarantining infected individuals, often referred to as ‘shutting up’, which included not only the infected person but anyone who resided in their dwelling.³

This also included moving sick persons to pesthouses where they were to remain for forty days. Not surprisingly, there was animosity towards quarantine and widespread readiness to break the law to survive.

The plague also led to His Majesty's Special Command (under King Charles II) to issue rules and orders for prevention of the spreading

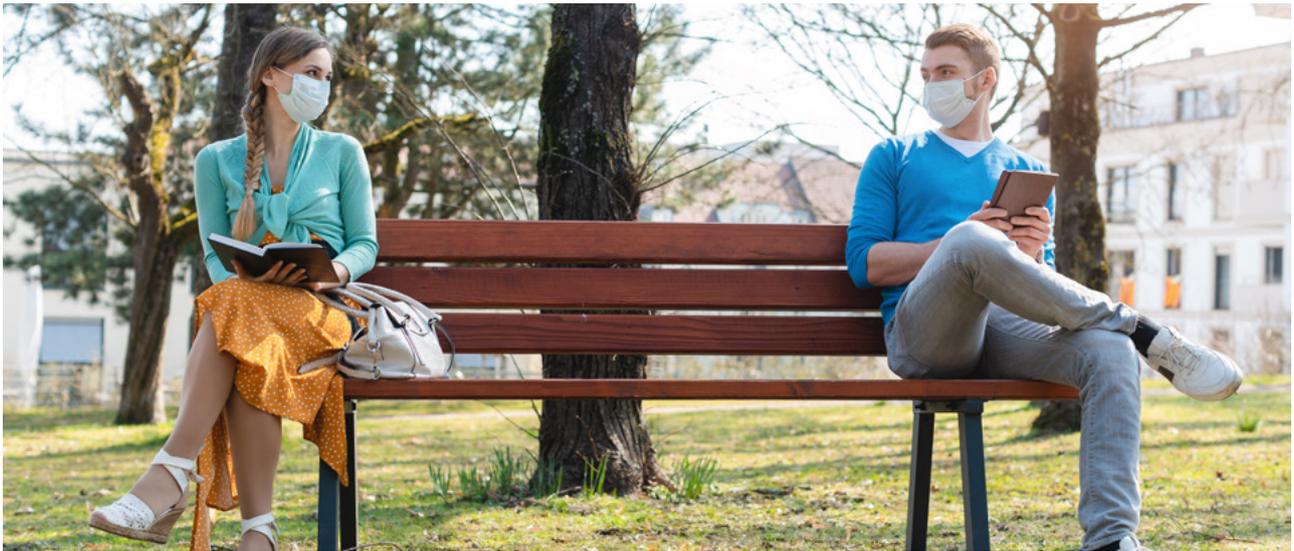
of infection, which included the prohibition of all public gatherings, including funerals.

Use of masks and other protective clothing

The widespread image of citizens wearing surgical masks during the COVID-19 epidemic has raised many questions about their historical precedence and efficacy.

We have been reminded often of the villainous, beak-like masks worn by doctors in Europe during the 17th century bubonic plague epidemic. These doctors wore head-to-toe robes, long leather gloves, goggles, and a mask with a long beak. Until the germ theory of disease was widely accepted, doctors blamed miasma (noxious bad air) to understand the spread of disease, so the mask was filled with herbs and other substances to cleanse the air before it was inhaled. There is no data on their effectiveness. These doctors also carried a staff that assisted them to maintain space from plague victims or shove them away – a form of medieval physical distancing.

Contemporary disposable surgical masks are used differently, however there is confusion around who should wear such masks. At the time of



writing the prevailing view of the World Health Organisation is that such masks should be reserved for frontline public health personnel. Likewise, the Australian Government Department of Health advises most people will not benefit from wearing a surgical mask, and they should only be worn by sick people and health care workers who have frequent, close contact with COVID-19 patients.

There has been some discussion whether personnel in food businesses should wear masks. The advice from the US Food and Drug Administration is that if you were required to wear a disposable facemask in a food industry setting prior to the COVID-19 pandemic, based on a workplace hazard assessment, you should continue to do so. Otherwise there is no requirement to change practices. In some jurisdictions, personnel handling cooked or ready-to-eat food are required to wear some form of mask or spit guard to prevent them from coughing or sneezing over food.

Where disposable surgical masks are in use, they must be worn correctly and replaced frequently, as their period of effectiveness is quite limited once they become moist, soiled or damaged.

What practices should the food industry adopt?

As an essential industry, it is critical that our food industry workforces remain healthy and intact during the pandemic.

Recently, COVID-19 outbreaks have led to the shutdown of large meat processing operations in the United States and Australia. This demonstrates the need to embed changed physical arrangements and behavioural practices to limit the possible spread of the virus among teams.

This requires a range of logistical changes such as physically segregating work teams, implementing physical distancing guidelines on the processing and packing floor and addressing contamination risks at transfer points. Practices such as cleaning and sanitation between shifts must be implemented, and strict segregation in change rooms and lunchrooms instigated.

Food businesses are expected to do due diligence in assessing and identifying any potential risks to employees (and to food safety) and ensure employees adopt practices which minimise transmission of illness among work teams. Worker adherence to good hygienic practices remains essential, namely, ensuring that they do not attend the workplace when unwell.

There has also been the challenge of allaying consumer fears about the risk of coronavirus transmission by food or food packaging. The risk is exceedingly small, and much work has been done by food safety educators in undoing alarmist messages and

curbing unsafe food sanitation practices in the home.

Summary

Despite only utilising medieval methods for containing COVID-19 - quarantine, isolation, and contact tracing - there has been significant progress in halting the spread of the disease in Australia. It will be interesting to see if a return to some form of normalcy sees a slowing of the systematic design and implementation of revised working arrangements and practices in the food industry.

Will COVID-19 lead to renewed innovation in the food industry focussing on hygiene and worker health? Or will it be as Louis Pasteur once famously said: *c'est les microbes qui auront le dernier mot* (it is the microbes who have the last word)?

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Follow the RED recycled road

Words by Nerida Kelton



Of the nearly 1.1 million tonnes of plastic packaging placed onto the market in 2017-18, approximately 352,000 tonnes (33 per cent) were soft plastics. However, only 29,000 tonnes - or eight per cent of the soft plastic materials - was recycled. That figure is made up of around 28,000 tonnes recycled from commercial and industrial sources, but only 1,000 tonnes from consumers.

When you think of outdoor furniture, roads, bollards, fences, patio decking and even footbridges, you might not realise a growing number of these items are made incorporating recycled 'soft plastics'. This is one innovative way to recycle flexible packaging and materials that otherwise have no current home in Australia's kerbside recycling systems.

The low recycling figure for soft plastic has highlighted the need for industry and government to give added attention to developing a strong national consumer collection program for soft plastics, combined with investment in additional reprocessing facilities, and innovation to include recycled content in flexible materials.

Changes to procurement strategies are key to stimulate further investment in soft plastic recycling and reprocessing and to ensure

soft plastics are seen as a valuable resource that can be recycled, rather than disposed of as waste.

What does 'soft plastics' really mean?

Soft plastics are traditionally polyolefins, which is a collective description for plastics types that include polyethylene (PE), including high density polyethylene (HDPE), low density polyethylene (LDPE), linear low-density polyethylene (LLDPE), polypropylene (PP) and biaxially-oriented polypropylene (BOPP). The polyolefins are the most acceptable materials for current soft plastics recycling and reprocessing programs.

There are other potential materials used in soft plastics including: polyethylene terephthalate (PET), polyvinyl chloride (PVC), polystyrene (PS), ethylene-vinyl alcohol copolymer (EVOH), polylactic acid (PLA), bioplastics, aluminium, nylon and paper. These materials reduce the value of polyolefins and, in some cases, are incompatible with reprocessing systems.

The composition of soft plastic packaging can be broken down into two groups: mono-layer and multi-layer. Mono-layer packaging refers to the use of one polymer in the development of the material and quite often the material is PE. Multi-

layer packaging is composed of two or more materials bonded together through co-extrusion or lamination. The use of different material types together provides a package with unique barrier and mechanical properties.

Are soft plastics recyclable in Australia?

Currently, most Australian kerbside collection of recyclable packaging does not accept soft plastics. This restriction is required as the conventional Material Recovery Facilities (MRF) do not allow for the handling of film and flexible plastics because they get caught in machinery and cause failure or damage.

This restriction has also meant that many consumers are simply not aware that Australia does have recycling and reprocessing facilities available for the recovery of post-consumer soft plastic packaging. In fact, Australia has a number of companies actively and passionately working hard to create new innovative solutions that will ultimately minimise the amount of soft plastics that head to landfill or end up in the environment. These companies include RED Group, Replas, Close the Loop, Plastic Forests and Newtecpoly, among others.



Household soft plastics collection

RED Group is the sustainability and resource recovery organisation that developed and implemented the REDcycle program in 2011. REDcycle is an innovative recovery model for post-consumer, soft plastic packaging.

The program started with 100 Melbourne supermarkets and today has 1,830 retail drop off points located primarily in Coles and Woolworths supermarkets across Australia. With this number of stores and locations provided as consumer drop off points for soft plastic packaging, the REDcycle program is classified as 'Widely Accepted' recyclability. More than 80 per cent of the population has access to the collection bins.

The REDcycle program is a true product stewardship model where manufacturers, retailers and households share the responsibility to create a sustainable future for as many soft plastics as possible.

The cost of collecting and processing the material is covered by many of Australia's best-known brand owners and retailers. Together, Coles, Woolworths and brand owners enable the REDcycle program to make it easy for consumers to participate in the collection and recycling of household soft plastics.

What plastics does REDcycle accept?

In the simplest of terms, the REDcycle program accepts clean, dry, uncontaminated flexible packaging materials that meet the REDcycle material thresholds and have been approved through the Australasian Recycling Label (ARL) program. Packaging such as bread bags, pasta and rice bags, old shopping bags, biscuit and ice cream wrappers, confectionery and frozen food packaging, plastic bags, cereal box liners, fresh produce bags and Australia Post plastic satchels are all accepted via REDcycle.

The REDcycle program is recognised through the Australian Packaging Covenant Organisation (APCO) and the Australasian Recycling Label (ARL) program and have established 'return to store', 'store drop off' or REDcycle logos on-pack. All brand owners must become a REDcycle partner in order to use these symbols on-pack and are also required to join APCO. The 'return to store', 'store drop off' or REDcycle logos on-pack communicate to consumers that they can return the packaging to collection points within major retailers across Australia.

Partners within the REDcycle program have access to the Packaging Recyclability Evaluation Portal (PREP)

to assess the recyclability of their packaging within Australian recovery systems. Packaging and artwork must also be approved through the ARL program and meet REDcycle recycling requirements, to include the logo on-pack.

How do I know what to do?

Keep an eye out for the 'return to store', 'store drop off' or REDcycle logos that are increasingly being included on packaging as a part of the wider Australasian Recycling Label (ARL) program. If the packaging does not have one of these logos on-pack, it is either not a part of the program or the materials have not been approved as recyclable under the REDcycle program.

Consumers are encouraged to set up a soft plastics bin at home for clean and dry packaging and return the plastics back to retail stores that are participating in the REDcycle program. REDcycle collection bins are usually located at the front of stores near checkouts. If you are unable to locate a REDcycle bin, please ask one of the staff.

There are now 66 partners in the REDcycle program, including brands, packaging suppliers and retailers. Since 2012, the REDcycle program has recovered more than 950 million pieces of soft plastic returned by customers. The program successfully recovers approximately one million pieces of soft plastic per day and has diverted enough soft plastics to circle Australia three times.

The RED Group website www.redcycle.net.au offers detailed information on what soft plastics are accepted through the REDcycle program and provides a list of all collection points across the country for consumers.

What happens to soft plastics once collected?

RED Group collect, sort the recovered soft plastic film packaging and then send it on to their local partners:

Replas is Australia's leading mixed recycled plastic manufacturer which

aims to provide a solution for plastic waste by delivering quality, cost-effective and sustainable products. Replas blends mixed plastic with rigid plastics to form a material viable for use in the manufacture of new recycled plastic products. The company produces a range of more than 200 recycled plastic products including bollards, signage, outdoor furniture, fitness equipment and Enduroplank™ decking, as well as products suitable for traffic control, parks and gardens and the utilities industry. Replas aims to turn waste into robust recycled plastic products, while offering sustainable alternatives to the unnecessary use of virgin materials. www.replas.com.au

Close the Loop utilise REDcycle material as a component in high-performance recycled asphalt additive for road infrastructure known as Tonerplas™. Tonerplas is Close the Loop's ground-breaking asphalt additive which enhances the characteristics of asphalt. It produces a high-quality road surface which lasts 65 per cent longer than traditional asphalt and provides a major solution to the problematic waste issue of soft plastics. The formulated product is melted into the asphalt mix. Key partner Downer Group then adds recycled glass and recycled asphalt pavement to the mix to create a superior, lower carbon product that results in higher quality roads. One kilometre of road paved with plastic and glass modified asphalt

uses approximately 530,000 plastic shopping bag equivalents, 168,000 glass bottle equivalents, waste toner from 12,500 printer cartridges and 20 per cent reclaimed asphalt pavement. www.closetheLoop.com.au

Plastic Forests uses REDcycle material as a component of products such as mini wheel stops and air conditioner mounting blocks. Plastic Forests became the first company globally to commercialise a unique dry-cleaning process to recycle contaminated soft plastics, without using water. Used soft plastics are recycled into resin for use by the plastics industry or may be repurposed by Plastic Forests into a range of sustainable GreenMongrel brand products including dunnage, underground cable cover, garden edging, root barrier and GardenBed-Heart. www.plasticforests.com.au

How you can get involved in REDcycle

Everyone has a role to play in both collection of household soft plastics and the purchasing of end-products made from recycled content. There are several ways you can get involved in the program, both at work and at home.

If you would like to contribute personally, then start by making a 'soft plastics bin' at home and at work and arrange to return the packaging to your local collection point on a regular basis. Encourage others to do the same within your workplace and family.

Keep an eye out for products and brands that are advertising the 'return to store' and REDcycle logos on pack and, next time you are purchasing products, consider which brands are committed to the 2025 National Packaging Targets and National Waste Strategy.

The next time you need a deck, fence, garden bed or even a patio, consider sustainable solutions that are made from soft plastics. Not only are these solutions designed to be low maintenance, they are durable and capable of withstanding the harsh Australian climate.

Encourage your local council to support keeping soft plastics out of landfill by purchasing roads containing Tonerplas and Replas products, or by reviewing their procurement of outdoor furniture for recreational areas. Imagine if every school, park, recreational facility, government department and office building in Australia committed to purchasing products made from recycled content.

We all have a role to play. I encourage more companies to establish procurement strategies that actively encourage the purchase of recycled content to ensure we create a more sustainable world.

Nerida Kelton MAIP is executive director, Australian Institute of Packaging (AIP) and ANZ board member - World Packaging Organisation (WPO). 

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Fermented foods, the gut microbiome and human health

Words by Drs Miin Chan, Robyn Larsen and Kate Howell

Claims such as ‘Good for your guts’, ‘love ya guts’ and ‘gut flora warriors’ plus many others, are commonly found on the labels of fermented foods such as kombucha, kimchi and water kefir. But can consuming these traditional foods really improve gut health? And how do they impact our overall health?

We describe the emerging evidence, showing shifts in gut microbiome composition are associated with fermented food consumption, and discuss how the potential link between these changes and beneficial health outcomes requires further confirmation.

Despite an apparent paucity of strong evidence, some food businesses tout the health benefits of fermented products in order to harness the commercial power of a new health trend.

Microbial transformations

Fermented foods are created by the transformative action of defined or wild populations of microorganisms on raw ingredients. Yeasts, in particular *Saccharomyces cerevisiae*, and lactic acid bacteria, often of the *Lactobacillus* genus, are at the

forefront of these transformations, but a range of other fungi and bacteria may be involved.

Microbial fermentation of raw food components, such as simple sugars, carbohydrates and even proteins, fundamentally changes the appearance, taste, flavour, composition, nutritional content and category of the end product. Fermentation processes have been harnessed by humans to create celebratory foods and beverages (wine and beer), lengthen the shelf life of seasonal foods (sauerkraut and cheese) and enhance nutritional value (tempeh and bread).

Fermented products also play important cultural roles in our food systems. Our laboratory investigates the microbial composition, biodiversity and inter-kingdom interactions in these foods, and the important contributions the microbes and their activities have on flavour, aroma, nutrition and quality.

Microbes in the marketplace

Recent market trends show increasing popularity of niche fermented products that contain live probiotic bacteria. This trend is likely to reflect

increasing public awareness of the role that the gut microbiota plays in human health.

Common probiotic-containing foods include yoghurt, water kefir, sauerkraut and kimchi, but Australians are not typically big consumers of probiotic-containing foods. The most recent national nutrition survey revealed that yoghurt, the main dietary source of probiotic bacteria, contributed only -1.5 per cent of total daily energy, and the contribution of other fermented foods was minimal.

Some of the products that have gained popularity over recent years include the bacteria and yeast-cultured beverages kefir (water or milk-based) and kombucha (tea). Supermarkets and convenience stores provide no shortage of beverages on the shelf touting their benefits for gut health. The increasing variety and accessibility of these products may be partly fuelled by the anti-sugar movement and the commercial beverage sector seeking healthier alternatives.

Driven by consumer demand, kombucha now represents the fastest growing beverage category in Australia. However, it remains unclear

whether customers are choosing these products for their perceived health benefits, or whether they are merely substituting it in place of less favourable sugar-laden options.

Go with your gut

The question of whether these foods are indeed ‘good for your guts’ relates to the recent uncovering of the role of the gut microbiome in human health. An explosion in next generation sequencing, which rapidly identifies microbial DNA based on barcoding regions, has led to an incredible increase in sampling. Using human faecal samples as a proxy for the gut flora allows us to investigate the association of gut microbiome with health outcomes, from metabolic to mental health.

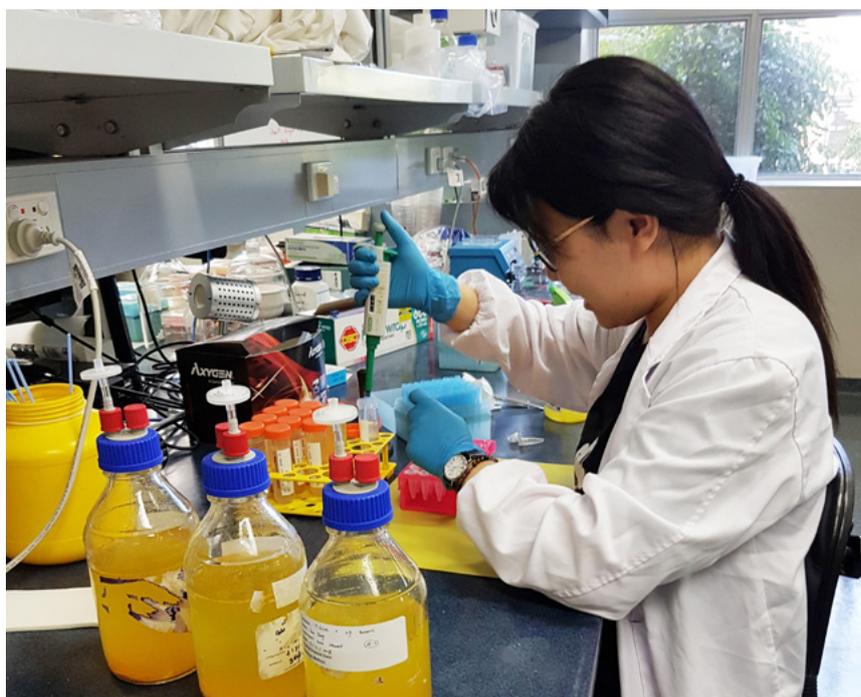
Only now are we getting a view of how the incredible microbial diversity of the human gastrointestinal tract can affect health. Some very exciting research has looked at the interplay of bacterial cell components and the gastrointestinal wall,^{1,2} the effect of microbially produced short chain fatty acids on the health of colonocytes,³ and the role of microbial metabolites in human metabolic health regulation.⁴

Probiotics, prebiotics and biogenics

Many fermented foods contain live microorganisms, some of which are probiotic, conferring health benefits when consumed in adequate quantities. In this way, beneficial microbes are delivered to the gastrointestinal tract where they have been shown to transiently integrate with commensal gut microbes.

Acting locally, they may improve gut barrier function, reduce inflammatory responses and protect against pathogens. We conducted a recent *in vitro* digestion study which showed the microorganisms delivered in a water kefir liquor matrix were bile and acid tolerant, and thus are likely to successfully traverse a model human GI tract in adequate numbers.

Fermented foods also contain microbiota-associated carbohydrates that are consumed by commensal



Master of Food Science student Fan Yang investigates the microbial composition of water kefir.

gut microbes to produce beneficial short chain fatty acids. Last but not least, microbial metabolites and other end products found in fermented products, known as biogenics, also have a role to play in conferring health benefits. Polyphenols and their microbially produced metabolites are, for example, implicated in ameliorating inflammation⁵ and can have complex interactions with the gut microbiome.⁶

What's the evidence?

The health effects of fermented products vary depending on the provided substrates, fermentation techniques and microbial growing conditions.

A recent systematic review and meta analyses showed that fermented dairy consumption is associated with reduced cardiovascular risk.⁷ Yogurt intake was shown to be associated with a reduced risk of type 2 diabetes, obesity and metabolic syndrome development in the general population. An earlier review of fermented foods and noncommunicable diseases mainly showed moderate metabolic benefit from fermented dairy consumption.⁸

We are currently conducting a systematic review of plant-based fermented foods on cardiometabolic

outcomes.⁹ Despite the heterogeneity of studies, we have so far found that kimchi and fermented bean pastes have beneficial effects on metabolic parameters. However, we note the heterogeneity and paucity of human clinical trials in this area.

Fermented foods and the gut microbiome

What role does the gut microbiome play in this complex relationship? A seminal review by Marco *et al.*¹⁰ first summarised the likely mechanisms of the fermented food-gut microbiome-human health complex.

As part of the American Gut project, a recent study examined the impact of fermented foods on the human gut microbiome and metabolome.¹¹ The American Gut Project has more than 21,000 participants who have donated stool samples and lifestyle questionnaire responses. The authors investigated 8,000 samples, categorised consumption of fermented food and linked amplicon diversity and metagenomic profiling with the functional properties of the gut.

They found that consumers of fermented products display subtle differences in their gut microbiota through enrichment with beneficial



Fermented vegetables, such as sauerkraut made from cabbage, are experiencing a resurgence in popularity.

conjugated linoleic acid. However, much more research is required, from basic research through to human clinical trials, to further elucidate clear mechanisms.

In that vein, we are currently sourcing funding to conduct a gold-standard, randomised controlled clinical trial exploring the effects of probiotic water kefir on metabolic parameters and gut microbiota profiles in obese, prediabetic adults. This research will be the first of its kind, providing important insights into the fermented foods and probiotics-gut microbiome-chronic lifestyle disease complex.

Conclusion

So, is all the evidence there? Clearly, at a fine scale, individual microbes or consortia can assist in localised benefits to parts of the GI tract, and there are causal relationships between diet and a change in microbiome relative composition.

It will be interesting to see how the evidence continues to emerge, as one of the biggest challenges is agreeing on a working definition of 'healthy'. Suffice to say, the evidence is certainly not strong enough to support much of the current marketing hype associated with fermented foods.

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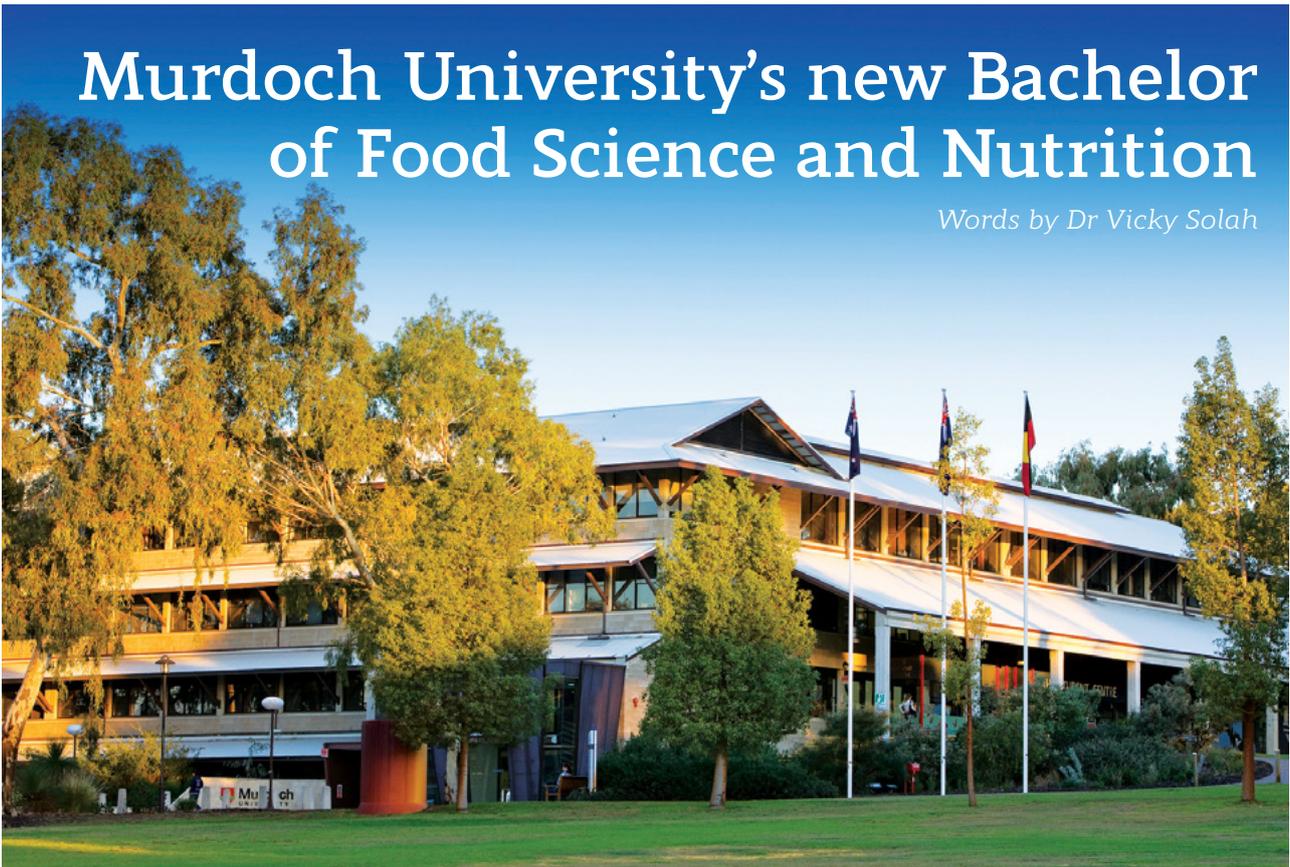
Dr Miin Chan (MBBS, UMelb) is a medical doctor, keen science communicator and Slow Food Melbourne farmers' market manager. She is currently undertaking a PhD in fermented foods, the gut microbiome and metabolic health at the School of Food and Agriculture at University of Melbourne. Follow her at @dr.chans.

Dr Robyn Larsen (PhD, RMIT) is a nutritional biochemist, currently employed as a lecturer in human nutrition within the School of Agriculture and Food at University of Melbourne. She is a registered nutritionist with >12 years' experience working across a broad range of nutrition-related health research.

Dr Kate Howell (PhD, UNSW) is a microbiologist and biochemist employed at University of Melbourne. Her research encompasses the interactions of microbes, particularly yeasts, in complex environments found in food and agriculture. She is the director of research training in the School of Agriculture and Food and teaches subjects in food and nutrition at undergraduate and postgraduate level. Follow her at @katehowell3010. 

Murdoch University's new Bachelor of Food Science and Nutrition

Words by Dr Vicky Solah



Murdoch University has recently launched a new Bachelor of Food Science and Nutrition (BFoodScNutr) degree within the College of Science, Health, Engineering and Education.

The College of Science, Health, Engineering and Education is led by Pro Vice Chancellor, Professor Catherine Itsiopoulos, a nationally and internationally recognised academic leader in dietetics and Mediterranean diet research. The new Food Science and Nutrition program is led by Associate Professor Vicky Solah, a leader in education and experienced researcher working in food science and human nutrition.

Food Futures, Health Futures and Environment Futures are Murdoch University's three key research themes and these themes will also reflect strongly in the teaching of the BFoodScNutr degree.

The new degree has a strong nutrition focus and aims to help 'foodies' find their dream job as food scientists and nutritionists. The global trend towards personalised nutrition

means there is a growing need for culinary skills and novel food product design, with many new opportunities to work across nutrition, consumer science, food product development and food safety already becoming available.

The degree has been developed by a strong team with expertise in human physiology, biochemistry, biotechnology, agriculture, food science and nutrition education and research, with the first enrolments commencing at the beginning of this year.

Subjects such as human physiology, biochemistry, principles of nutrition, food science, food biotechnology, nutrition and disease, food and society, and food product development will prepare graduates working in health science, the food sector or human nutrition science fields, both locally and globally. Subject topics include: the role of food and nutrition in human health and illness prevention; food composition knowledge and culinary skills; novel food product design; the role of food

and nutrition in sport performance and cognitive performance and an understanding of food and its impacts on the human microbiome.

Students will study at the Murdoch Health Precinct, including public and private hospitals and the Australian National Phenome Centre. The course also offers the opportunity for students to work closely with industry as part of the Agri-Innovation Precinct in the Peel business park at Nambeelup in Western Australia.

The course also aims to provide a pathway to further study in dietetics, food science, health and nutrition as part of honours and doctoral research programs.

For more information, visit www.murdoch.edu.au or contact Associate Professor Vicky Solah, Vicky.Solah@murdoch.edu.au.

Associate Professor Vicky Solah (PhD FAIFST) heads the Food Science and Nutrition program at Murdoch University in Western Australia. 

Engaging a food science and technology consultant has benefits

Words by AIFST consultants special interest group



Food scientists and food technologists are those who study, research, innovate and improve food products and processes to ensure safety, quality and nutritional adequacy are maintained in food products for a vast range of consumer needs.

Food technology consultants are experienced food industry professionals who have augmented their technical expertise with business, project development and delivery skills. Some have national and international experience, together with senior level business experience as a senior manager, director or CEO.

Many are operating their own consultancy business and understand the nature and confidentiality of business dealings. They are critical thinkers who can review your wants, establish your needs and communicate clearly to provide insights into your food business based on the facts available.

Many larger food and agri-business companies employ their own food technologists with skills specific to their products and production systems. However, smaller enterprises and startup companies often can't justify this expense. Even large companies

can find it difficult to employ technologists with the full range of skills they require, as the need for those skills may be intermittent or changing. A better solution is to utilise the services of consultants who can be chosen for specific skills required for a defined period of time.

A food technologist can be quickly engaged to fill knowledge gaps in a growing and changing business, particularly if the task is not provided for in the current human resources budget. The services of a consultant can be very cost effective as the business is not paying for downtime, but only meeting the cost of an agreed task.

In addition, when special projects are identified that are outside the scope of current business capability, they can be used to fill knowledge gaps and help companies develop in-house technologies to meet future needs. With their mix of business, technical and industry expertise, skills and experience, consultants can appreciate the complexity of food systems and the implications around choices of ingredients, process, quality and food safety. They can not only deliver a solution more efficiently than in-house expertise, but can also assist business

growth and profitability.

Once you have decided that engaging a consultant is the best option, the first step is choosing the right consultant. The AIFST has a consultants register that might make a useful starting place. You should discuss your requirements, timeframes and budget with several consultants and enquire about relevant experience and references, understanding that confidentiality will be observed. It is also important to consider with whom you can relate and who could be the best fit for your business. Once you have chosen the appropriate consultant, you should move on to the important business of agreeing on the scope and price.

To get the best value from a consultant, both the company and the consultant need to be clear about the task, the specific standard of the output(s), and the time frame. Once the consultant has this information they can offer a proposal. It is a good idea for the company to be realistic about what can be achieved with the budget they have and, if necessary, work with the consultant to manage the scope of work to reflect this.

Often it is a good idea to stage a large project into a number of smaller affordable elements with a STOP/GO point at the end of each stage. In all cases, it is important to engage in frequent communication. This informs the consultant if they are on track and helps you provide timely information that might be essential to completing the work.

You can read more about Food Science and Technology at www.aifst.asn.au/what-is-food-science.

The AIFST consultants special interest group meets regularly to discuss matters of mutual interest to grow, learn and connect. 

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Recent developments in cultivated meat production

Words by Dr Robyn Warner

Cell-based or ‘cultivated’ meat has attracted much media interest recently as a proposed solution for food security, provision of safe and affordable protein and as a solution for the unsustainable impact of animal production on the environment.¹

The common terms used for this type of meat production include lab, cultured, in vitro, artificial, synthetic, clean, or most recently, cultivated meat. In this article, I use the term c-meat as it encompasses cultivated, cultured, cell-based and clean meat. C-meat is one aspect of cellular agriculture which involves the production of foods from cells, rather than from whole plants or animals, as well as a small part of the alternative protein landscape for future food.²

The definition of c-meat production is: meat made from stem cells which tries to mimic traditional meat.

Exactly when c-meat will start appearing in supermarkets and restaurants is uncertain, but it’s predicted to be some time within the next ten years. The timing is reliant on the development of cost-effective procedures for scale-up from lab to commercial production and the development of regulation and labelling procedures.

Processes and techniques

The techniques for culturing cells are not new. The first successful culture of cells from a chicken embryo was in 1885 and the limited life span of stem cells in vivo – something that remains a challenge in c-meat production today – was first described in 1962.¹

The processes and techniques required to make and scale-up c-meat production include cell line development and large scale cell cultivation.

Cell line development

Many potential sources of cells exist including biopsies from live animals, embryonic stem cells, and bone marrow or other inducible stem cells.³ Stem cells have a unique ability to develop into many different cell types and all stem cells can self-renew (make copies of themselves through division) and differentiate (develop into more specialised cells).

Currently, the most successful approach has been achieved using stem cells derived from muscle satellite cells from mature animals. However, while these are the easiest cells to culture, they have a limited life span.

Cell cultivation

Growth of cells in culture requires nutrients, similar to cells in living tissue.

In the absence of a blood supply providing nutrients and removing waste, cells are bathed in a culture media which provides important nutrients and growth factors. The culture media usually contains 10-20 per cent growth media traditionally derived from calf or bovine serum, which is currently prohibitively expensive.

Structured c-meat tissue can only be produced by cultivating fully functioning skeletal muscle cells. These need to attach to some form of mesh scaffold, such as collagen, which provides support and enables cell differentiation and growth.

The collagen scaffold can either become part of the product, if edible, or the cells can be removed and the scaffold recycled for the next batch. Research is ongoing globally to identify cost-effective, animal-free growth media and scaffolds that can be used in the scaling-up process.

Scaling up

Once a cell line has been established, production must move from the lab bench to large scale production in bioreactors. However, muscle is not composed only of muscle cells, but also fat cells, connective tissue and vascular tissue.

Currently, due to the complexity of cultivating each individual cell type,

co-culture of all these cells has not yet been achieved. It is the lack of a vascular system in the current muscle cell culture systems that limits the width of the muscle cell tissue to just several cells thick.

Manufacturing products

Existing c-meat processes can produce a complex of muscle cells which can be formed into a burger or pattie. A c-meat pattie could be made of 100 per cent muscle cells, however, this would be extremely expensive and would not mimic the composition of real meat. So, a c-meat pattie would more likely be made of around 10 per cent muscle cells.

For food ingredient applications, it is possible to blend muscle cells with non-meat ingredients, such as cereals or pulses, to form complex food pastes that can then be structured using a process such as extrusion or bio-printing. However, a key challenge in the scaling-up process for c-meat is the formulation of products, as the simulation of texture, flavour and mouthfeel in animal-derived meat products is complex and is an essential consideration for consumer acceptance.

Sustainability

Sustainability of c-meat production, measured as reduced greenhouse gas emissions (GHGe), over conventional livestock production systems, especially beef, has been proposed as the most important advantage of c-meat.

Available data predicts that c-meat production will result in lower GHGe than beef, but equivalent to poultry or pig production.¹ Energy and water usage will likely be higher and, in times of increasing water scarcity⁴ and increased need for decarbonisation of energy, these are important considerations. As c-meat production is not presently available at commercial scale, it is difficult to accurately predict the sustainability of the industry.¹

Food security

Food security indicators show meat production increases of 50–100 per cent are required to maintain the future per capita demand of growing

populations, and any increase would come at high environmental cost. C-meat production will therefore most likely supplement meat protein from animal sources.

Due to high demand for meat protein, and potential increased consumption in poor countries, some predictions include a scenario where meat-animal production from agriculture is maintained alongside a c-meat industry. Depending on the costs of production, it is also possible that c-meat products may become a niche product for affluent consumers.

Public health

Foodborne pathogens such as salmonella, campylobacter, listeria and escherichia coli are responsible for many cases of human illness and sometimes death.

As c-meat reduces human-animal interaction, it is expected to reduce the incidence of epidemic zoonoses and may also reduce the risk of foodborne pathogens. Conversely, antimicrobials will likely be required during c-meat production to eliminate pathogen growth, and the use of antimicrobials is a concern for public and consumer health and safety.

However, there will be reduced exposure to dangerous chemicals such as pesticides and fungicides in animal production, which can be harmful for humans as well as wildlife.

C-meat can also be engineered to be healthier and more functional by manipulating the culture media to change levels of nutrients, vitamins, fatty acids or fat content. It goes without saying that all compounds and chemicals used during production and processing will need to be documented for regulation and labelling.

A range of regulatory hurdles will need to be met before c-meat can reach the consumer. For the c-meat industry to succeed, companies will also need assurance their products will be responsibly regulated. To this end, in 2019 the USDA and FDA formalised a Memorandum of Understanding outlining their planned cooperative approach toward future regulation of c-meat.³ Regulations presently being developed in the US will be watched

closely as they will provide guiding principles for regulators in other countries.

Australian opportunity

With 45 companies worldwide involved in various aspects of c-meat production (and two in Australia since 2019),⁵ the industry has an estimated projected value of US\$23 billion by 2023.⁶ Large multinational meat processing and food companies, as well as governments in some countries, are investing in the category⁷ and, as such, there is no doubt a healthy c-meat industry is emerging.

The role Australia chooses to play will be pivotal in whether we become a product-importer or global collaborator and exporter of c-meat technology and products. Given Australia is internationally recognised for world-leading food and medical research, government support for innovation alongside start-ups - and timely development of regulatory guidelines - should make the development of c-meat technologies, and a c-meat industry, possible in Australia.

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Prof. Robyn Warner is the domain leader for food and nutritional science in the School of Agriculture and Food at University of Melbourne. She is Australia's contact person for the Annual International Congress of Meat Science and Technology, editor-in-chief for the meat science section of the online journal Food, and chair of the Melbourne University sponsored hallmark research project, Initiative Future Food.





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The COVID-19 pandemic brought many challenges for the industry - what are some key learnings?

Stuart Hastie

***New product development manager,
Grain & Bake Co. Aust***

COVID-19 has brought a lot of key learnings and insights. It has certainly underlined the importance of maintaining a safe and wholesome food supply that consumers can have confidence in. To maintain this, it is necessary to be able to adapt to a dynamic environment through innovation and critical evaluation. It has forced a re-evaluation of how business operates, from the risk assessment of supply chain, through to vulnerability in our processes and how we manage teams for their safety (physical and mental health), while maintaining strong communication and situational awareness. This has emphasised the need to be able to adapt in an agile and innovative manner whilst maintaining consumer confidence.

Ishan Galapathay

***Productivity expert and founding
director of Capability Unlimited***

The biggest learning I've seen is that we've learnt to challenge the status quo.

We have challenged:

- Product and service offerings to explore which ones make sense to continue and which ones to discontinue
- Team structures and capabilities to support future opportunities
- Space - do we need all this space?
- Teaming remotely - how to maintain productivity and communication with remote teams
- Our ability to adapt - how quickly can we learn new skills and tasks to continue services

I think we have just seen the best demonstration of the statement which is attributed to Charles Darwin: "It is not the strongest species that survive, nor the most intelligent, but the most responsive to change."

It would be disappointing if we returned to our previous status quo without taking up this opportunity to advance our companies, teams, individuals and even humanity.

Vicky Solah

***Associate professor, food science and
nutrition in the College of Science,
Health, Engineering and Education at
Murdoch University***

While Australia does not suffer from food insecurity, we do have a supply problem. In addition, Australia contributes to the food security of many countries, so we need to address the stability of supply domestically to support our export markets and world food security.

Key Learnings include:

1. Domestic food stability requires a rethink, and investment in food processing in Australia is essential
2. Export that relies on using air freight capacity on passenger planes needs alternative and cheaper ways to get to market, and innovative ways to extend shelf-life
3. Physical distancing and increased personal hygiene has had a positive impact on food safety, as it not only reduces a person's risk of picking up coronavirus, but also the risk of picking up gastroenteritis.

Sharon Natoli

Director, Food & Nutrition Australia

In times of challenge, such as COVID-19, the messages we send are more impactful. People want to believe their leaders know what they are doing and responding quickly is paramount. The importance of remaining calm, providing consumer reassurance and establishing an organisational environment that enables teams to pivot with speed have all been key learnings.

Panic buying early on was a reminder of the fear associated with the threat

of running out of food, meaning leaders who stepped up to provide reassurance about safety and supply have benefited from building trusting relationships, an outcome that will serve the industry well in the long run.

For marketing and innovation, COVID-19 has highlighted the benefits of developing an ongoing and close relationship with consumers, understanding their key values and concerns and being able to adapt messaging and priorities quickly. This requires an organisational culture that supports the establishment of a two-way relationship, one which moves from simply seeking opportunities to sell more food, to partnering with consumers in a way that helps solve both their short and long term issues and concerns.

Tom Ross

***Professor in food microbiology at
University of Tasmania***

The coronavirus (SARS-CoV-2) causing the current pandemic is not a foodborne disease (ie., there is minimal food safety risk), but it is certainly having consequences for the Australian and global food industries.

Despite the fact that SARS-CoV-2 does not cause foodborne illness, foods can act as a fomite for its transmission. Public health authorities have been incredibly alert in educating businesses to minimise the transmission of SARS-CoV-2 by this route, for example, by placing hand sanitisers at the entry to food stores and bottle shops where people routinely handle food products but don't always buy them.

Increased awareness of the modes of transmission of infectious diseases might provide long term lessons about the need for personal hygiene in food stores and food service, and that might in future lead to reduced transmission of gastro-intestinal illness from infected people handling foods in food stores.

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