



Food integrity

Three key figures in the industry discuss the biggest challenges in food safety and fraud, exploring how food integrity has evolved and anticipated future issues.

Q: In your opinion, what areas of food adulteration should we be most concerned about?

Dr Mary McBride (MM): It is important to establish the nature of food fraud in the first instance. It is the deliberate action of a person or business to misrepresent the contents of a food product for commercial or financial gain. Food fraud can damage brand reputations and undermine consumer trust, but fraud that creates food safety issues – where consumers may get sick or even die as a consequence of economically-motivated adulteration (when premium products are

substituted with cheaper alternatives to increase profits) is of greatest concern.

Premium products, and easily substituted foods like juice or milk, have always been vulnerable to food fraud, but the global pandemic has turned the food industry – and global supply chains – on its head. Disruptions to the supply and demand equilibrium create opportunities for fraud, thus even lower price commodities like wheat and rice are now targets for fraudsters.

Cathy Baillie (CB): As well as the pandemic having an impact, we are also experiencing a complex set of pressures on reliable access to

food, known as food security, resulting from climate change, wars and sanctions that mean farmers are increasingly seeking returns on crops contaminated by mycotoxins and heavy metals, as well as intensifying their reliance on plant protection products.

Q: Is there a particular commodity you are focusing on?

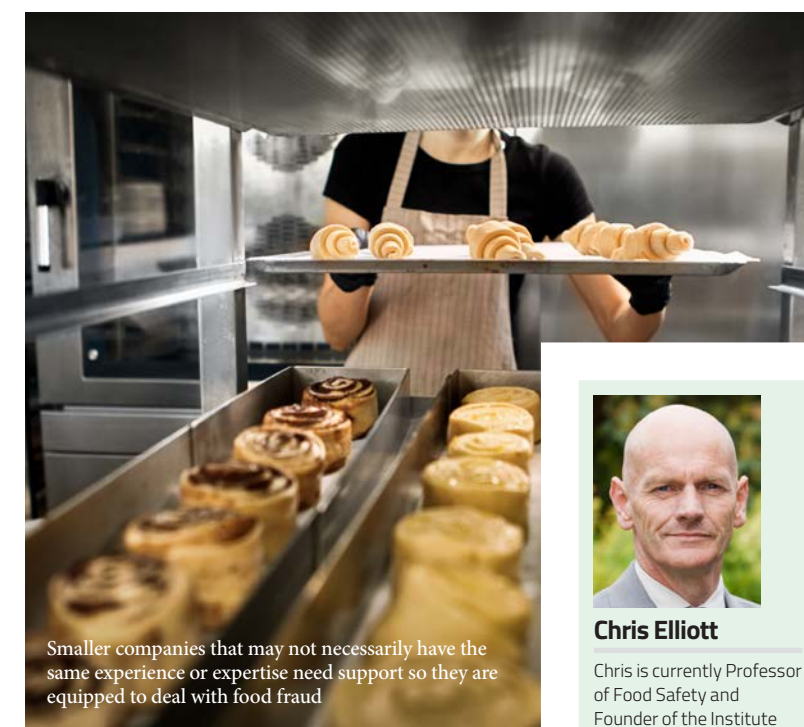
Professor Chris Elliott (CE): One of the greatest consumer risks that falls under the food fraud bracket is the fraudulent introduction of food allergens into food products. This aspect of food fraud should be a particular concern as it has the potential to cause significant health issues for a large portion of society. Another current focus is soya fraud; trying to determine if claims that it comes from sustainable sources are really true. Then you have emerging foodstuffs which come with new avenues for food fraud: we are looking carefully at the opportunities the explosion in emerging proteins will bring to those who cheat in our global food supply system.

CB: Food fraud is not mutual; it does not provide consumers or their pets with quality, and it can be dangerous to health. As a global food manufacturer, Mars believes it has a responsibility to lead in food safety by sharing knowledge and helping to unlock solutions. We have a clear vision of providing safe food for all. The areas of food adulteration we are most concerned about are those that result in a food safety risk, be that physical, chemical or biological. These risks apply across the food supply chain, and across the board when it comes to raw materials, but key targets include commodities such as rice and cocoa.

MM: With all these new and emerging challenges related to combatting fraud in unexpected commodities, at Agilent we believe we must cast a wider net for testing and analysis; thus the development of novel, non-targeted approaches can help pick up adulterants that might otherwise be missed.

Q: Given these difficulties, how can we raise the bar for food fraud prevention, making it challenging for criminals to deliberately adulterate food?

CB: This is no easy task because ultimately it requires action on all three sides of the food fraud triangle. That means removing the motivation to commit fraud by addressing the root causes of food insecurity and financial distress. It means removing the fraud opportunity by increasing surveillance and traceability. It means addressing the false



Chris Elliott

Chris is currently Professor of Food Safety and Founder of the Institute for Global Food Security at Queen's University, Belfast. He has published more than 500 peer reviewed articles, many of them relating to the detection and control of agriculture, food and environmental related contaminants. His main research interests are in the development of innovative techniques to provide early warning of toxin threats across complex food supply systems. Protecting the integrity of the food supply chain from fraud is also a key research topic and Chris led the independent review of Britain's food system following the 2013 horsemeat scandal. Chris is a visiting Professor at the China Agriculture University in Beijing and the Chinese Academy of Sciences. He is a recipient of a Winston Churchill Fellowship and an elected Fellow of the Royal Society of Chemistry and Royal Society of Biology. Chris was awarded the Royal Society of Chemistry Theophilus Redwood Prize and an OBE in 2017. He was elected a member of the Royal Irish Academy in 2020 and became Vice President of the Chartered Institute of Environmental Health in 2021. Recently Chris was awarded the Agilent Thought Leaders Award for his work on food authenticity.

pretences of a potential fraudster's rationale by educating them about the harm caused by fraud. It means doing all three of these at every step of the food supply chain from farm to fork, hence why collaboration is so important.

CE: That is the key to it; we need better collaboration between food companies, much like the Food Industry Intelligence Network has accomplished in the UK. We also need to support small businesses who don't have the knowledge, experience, or technical teams required to deal with food fraud.

MM: Yes, food producers should provide training and education, conduct supply chain vulnerability assessments and proactively close gaps. Actionable initiatives such as enhancing track-and-trace capabilities through supply chain digitalisation will also reduce exposure. As will implementing globally harmonised policies, testing requirements and unified enforcement systems designed to deter fraud.

CE: The ability to detect food adulteration along supply chains will contribute enormously to countering the criminal elements, and portable detection technologies will be a huge asset in this respect.

MM: Indeed, analytical testing has a big role to play. Many authenticity testing methods require highly specialised instrumentation and skills, which can be costly for industry. Agilent is working with global thought leaders like Professor Chris Elliott »



Dr Mary McBride

Mary is Associate Vice President of Applied Markets at Agilent Technologies. She leads a team focused to develop strategy for growth across the Applied Segment markets (food, environmental, energy and chemical, materials, and forensics). In this role she also drives Agilent's end market strategic plan of record and translates market intelligence and market research into actionable insights, enabling informed business decisions and conveying a competitive advantage across Agilent chemical and life sciences markets. She and her team analyse market performance to support Agilent's senior Investor Relations communications. Mary has many years of business and market development experience and deep technical expertise in biological-based testing and biotechnology development. She holds a PhD in Analytical Chemistry from the University of California at Davis and has published more than 50 peer-reviewed papers and holds five patents.

Margins for the food industry are tight and this may hinder uptake of technologies that can help to reduce food fraud and enhance safety

and Professor Stéphane Bayen, McGill University to bring testing methods from the realm of the specialist into the routine testing environment. One great example of this is the recent rice authenticity consortium wherein Mars, Agilent and Queen's University Belfast, among others, collaborated to develop a set of two-tiered testing protocols to confirm the origins of rice in regions such as China and Thailand.

Q: Recent advances in sequencing technologies, syndromic surveillance and fingerprinting methods are creating exciting opportunities for food safety; how do you think they will help to ensure the integrity of our supply chains?

CB: As well as cost, one of the key barriers to the development and widespread use of technologies such as whole genome sequencing or food fingerprinting is the requirement for a robust, open access, global standard database. When a reference database is required, attention must be given to ensuring that it is sufficiently extensive to represent the commodity or contaminant under consideration. Methods that are not reproducible, are inaccurate, or rely on weak datasets to validate results, could cause manufacturers, at least,

to make the wrong decision when considering whether to accept or reject materials.

CE: These technologies have the capability to transform rapid testing for food adulteration, and safety is being increased thanks to the advances in these fields. However, it is important to ensure that the results of such testing should be part of digitally controlled supply chains to enable full transparency of many ingredients and commodities that are prone to fraud.

MM: There is no doubt that advanced technologies will play a significant role in the future of food safety and food authenticity. Right now, a major obstacle to broader adoption of these technologies is simply the cost. Margins are narrow in the food industry, and unless – and until – the cost to implement such technologies is reduced, they remain out of reach for many. However, these technologies can also be adapted and made available to consumers. When consumers can shop for food and test it in the market before they purchase, then the power shifts from criminals and fraudsters to consumers.

Q: What will food integrity risk and food fraud look like in the future?

MM: I find that when attempting to predict the future, it's helpful to analyse current megatrends and market dynamics. The pandemic has had such an impact on the food industry, leading to so many changes, that we are more aware than ever of the challenges we must confront. The global population is growing, and we must find new ways to ensure enough food that is safe and accessible. As Cathy mentioned, climate change, shifting geopolitics, the transition from fossil fuels to renewables, and consumer demand for nutritious, delicious and sustainable foods will all exert pressure on the food industry.

CB: Increasing pressures on food security resulting from climate change, wars and sanctions will inevitably flow on to food integrity and increase the risk of food fraud. Our ever-improving understanding of what 'optimal nutrition' looks like as we extend our lifespan with medical advances also means the definition of what food integrity actually looks like in practice will also change. The exciting thing is that these same technological advances will provide us with opportunities to also expand the range of what we currently consider to be food and best practice food production methods.

CE: For me, a true understanding of what a global food supply system operating under the principles

of integrity is what we must strive for. That means, a system with greater transparency, ensuring that all food is safe, authentic and produced in a sustainable way that protects all those that produce and consume our food.

Q: What steps are you taking to inspire the next generation to recognise the role of food safety science in ensuring a better world tomorrow?

CE: We must inspire the young to take up careers in food safety. Having quality education programmes and ensuring that they realise it is a career with great opportunities that can positively impact the lives of many is of fundamental importance.

MM: Education is key. At Agilent we actively collaborate with and support key partnerships within academia to encourage young people to pursue inspiring careers in food science. We have a significant focus to help food testing laboratories – in academia, government, industry and contract testing labs – overcome challenges due to declines in experience and skill sets. Through our corporate University Relations

Programs and the Agilent Foundation philanthropy, we also provide STEM grants and other forms of support for young students and scientists, and we conduct training and outreach across all geographies.

CB: Our aspiration is to be where people come to innovate and conduct groundbreaking research to tackle business and global challenges. We bring this to life through providing young researchers the chance to join teams working in R&D and our state-of-the-art research and science institutes: from the Mars Global Food Safety Center (GFSC), to the Waltham Petcare Science Institute, the Mars Advanced Research Institute and our Cocoa Flavanol Science Hub.

We also partner with leading academic institutions such as Queen's University, Belfast and Agilent. The Mars GFSC in particular raises food safety awareness through education, training and knowledge sharing. Since opening our doors, the Mars GFSC has hosted more than 1,000 visitors from around the world. We believe it is vital that we all continue to work together to facilitate the growth of research in food safety science so that we can continue to work towards a world in which there is safe food for all. □



Cathy Baillie

Cathy is a food technologist with over 30 years' experience primarily in food and petcare, leading teams in innovation, procurement, consumer care and quality, and food safety, including the establishment of green field manufacturing sites on three continents. Cathy currently lives in Australia and has been the Corporate Food Integrity Manager at Mars, Incorporated for six years, developing globally applicable best practice approaches to the management of food fraud, foreign materials and food defence.

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