

# NEW Food



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Towards a safer workplace: taking steps to improve health and safety in food processing

Improving understanding of the adverse effects of mycotoxins and how to limit their health impact

How to tackle the global food security crisis as the population increases and diets change

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## Food Analysis

Consumer food testing devices:  
threat or opportunity?







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# Safety, safety, safety

In this issue we take an in-depth look at various safety issues affecting the industry.



**STEVE BREMER**  
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CHLORINE washing of poultry has been in the news recently, largely in relation to Brexit, and is a controversial subject that divides opinion. Some countries wash their chicken in chlorine while others don't – there appears to be no definitive 'right' or 'wrong' solution to the issue. In this issue, Andrew Hudson provides a balanced view from the scientific perspective (page 8).

Still on the subject of food safety, mycotoxin contamination is thought to be one of the biggest risks, and a problem that may get worse with climate change. We have three excellent articles on various aspects of mycotoxin detection and control in this issue. Chris Elliott asks whether it is time for a global rethink on the subject, suggesting better understanding would help

tackle the problem (p40). Vanessa Cowan and Barry Blakley discuss the safety risks associated with mycotoxin contamination of food and animal feeds, basing their arguments on work they have carried out at the University of Saskatchewan (p44). And Ahmad Alshannaq and Jae-Hyuk Yu consider which foods are most susceptible to contamination and the best analytical methods for detection (p49).

Safety is not only an issue for consumers, however. Food processing can be a dangerous sector for employees, with an injury rate more than double the average for the manufacturing sector as a whole. In this issue, Health and Safety Executive Inspector Warren Pennington describes initiatives to improve workplace safety (p16). And back to consumers, David Lindars, Technical Policy Advisor at the British Meat Processors Association, explains how standards for British pork are assured (p12).

If you are involved in food analysis, you will be interested in our two In-Depth Focus articles on the subject. Technological advances are bringing regular consumer testing of food for quality and safety closer to reality. François Bourdichon and Bert Pöpping discuss the implications of consumer testing for the industry on page 30. Does this represent a threat or an opportunity for the industry? Read the article and decide for yourself. Every year the European Food Safety Authority (EFSA) publishes data on zoonoses and foodborne disease outbreaks for member states of the EU, and the numbers for 2016 were released recently. Andrew Hudson distills a few points of interest from this complex document on page 34.

If you would like to share your own views or experiences of the food industry with other readers of New Food, don't hesitate to get in touch. You can also join our groups on social media platforms – simply search online for New Food.

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New Food is looking for authors for 2018. If you are from a food manufacturer, university association or research institute and are interested in submitting an article

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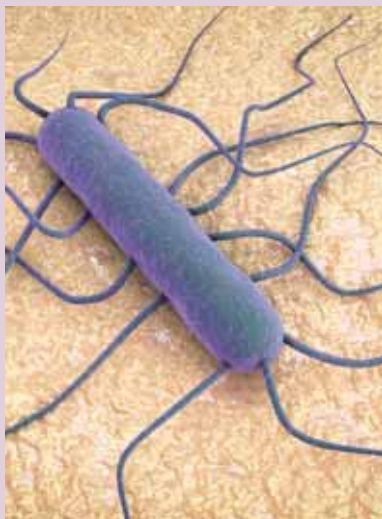
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# ROUND UP

The editor's pick of the most interesting developments within the food and beverage industry



## South Africa listeriosis outbreak the deadliest in recorded history

### FOOD SAFETY

AN OUTBREAK of the foodborne bacteria *Listeria monocytogenes* in South Africa has claimed more lives than any other outbreak in recorded history.

Nearly 70 people have died and 750 become ill in what has been described as the deadliest eruption of listeriosis in recorded history.

The outbreak of the foodborne disease was declared in December last year and has largely affected the Gauteng province, an area which includes Pretoria and Johannesburg. It has become the most lethal in history, outstripping the 1985 outbreak in the USA – caused by queso fresco cheese – by more than 10 deaths. No origin has yet been identified for the South African outbreak.

Dr Rufaro Chatora, a Country Representative from the World Health Organization, said: "The Government of South Africa shared the detailed information with WHO in compliance with the provisions of the International Health Regulations. This has helped South Africa and the Global Community at large to protect health, to stand ready to identify, to respond and to control outbreaks where they occur in keeping with the regulations."

## Data project could soon improve decision making for farmers and fishermen

### BIG DATA

A PROJECT co-funded by the EU's Horizon 2020 programme is looking at how massive flows of information collected from the soil, the air and satellites can boost agriculture and aquaculture. The Data-Driven Bioeconomy project (DataBio) looks to examine the applications of big data in farming, forestry and aquaculture, and how having more information at their fingertips might empower people working in these sectors.

This is part of an international consortium that VTT Technical Research Centre of Finland is developing to produce new solutions for the responsible and sustainable use of resources. The 26 agriculture, forestry and fishery DataBio pilots of the project are developing common software tools to analyse and refine information flows.

The pilot results and new solutions are also

expected to create new business opportunities and increase the use of big data technologies in the primary production for the bioeconomy industry. In the precision agriculture pilots, measurement on fields is mainly collected from local weather stations and sensors placed in the soil to ensure the optimal growth and development of the crop.

The DataBio consortium includes 48 partners from 17 countries. The total budget of the three-year project is €16.2m. In addition to Finland, the other countries taking part in the project are Belgium, Czech Republic, Germany, Spain, Norway, Poland, Italy, Greece, Israel, the Netherlands, Denmark, Switzerland, the United Kingdom, Estonia, France and Romania. Intrasoft is responsible for the administrative coordination of the project. The project will end in 2019.

## New study delves into the global value of urban agriculture

### ECOSYSTEM

A STUDY by the National Science Foundation (NSF), Arizona State University (ASU) and Google researchers has used a data-driven approach to assess the value of urban agriculture and quantify its benefits at a global scale.

"For the first time, we have a data-driven approach that quantifies the ecosystem benefits from urban agriculture," said Matei Georgescu, a geographer at ASU and corresponding author of the paper. "Our estimates of ecosystem benefits show the potential for millions of tons of food production, thousands of tons of nitrogen sequestration, billions of kilowatt hours of energy savings, and billions of cubic metres of avoided storm runoff."

The researchers estimated the annual value of selected ecosystem benefits of urban agriculture at approximately \$33bn. They report their findings in a paper published in the current issue of the American Geophysical Union journal *Earth's Future*.

To develop global scale estimates, the researchers analysed global human population numbers, urban terrain, and Food and Agricultural Organization (FAO) datasets in Google Earth Engine. They then aggregated the data by country. They projected an annual food production of 100 to 180 million tons, energy savings of 14 to 15 billion kilowatt hours (from insulation properties provided by rooftop urban agriculture), nitrogen sequestration between 100,000 and 170,000 tons, and avoided storm runoff of 45 to 57 billion cubic metres annually.

They estimate that with intense implementation, the overall worth of urban agriculture could be as much as \$80bn to \$160bn annually. Urban agriculture, the researchers say, could help feed a world that may face future challenges in industrial agriculture as a result of climate change.

## Low-cost bacterial detection technology uses smartphone camera

### CONSUMER TESTING

SCIENTISTS are developing a dual-part detection method that can search for traces of bacteria in water or food samples using a smartphone and a \$30 microscope add-on.

Smartphone cameras form part of a developing method to detect bacteria on food or in water samples – a low-cost solution that researchers say could appeal to restaurant chefs or aid workers in disaster relief zones. Along with a \$30 microscope lens, the smartphone is the optical part of an optical-chemical technique being tested by researchers at the University of Massachusetts Amherst.

Led by food scientist Lili He, the team designed a sensitive and reliable bacteria-detecting chip that can test whether fresh spinach or apple juice, for example, carry a bacterial load. The chip, used with a light microscope for optical detection,

relies on what He calls a 'capture molecule' – 3-mercaptophenylboronic acid (3-MBPA) – that attracts and binds to any bacteria.

The chemical detection method, surface-enhanced Raman spectroscopy (SERS), relies on silver nanoparticles. The techniques are now in the patenting process.

The first step in the new test for bacteria detection is to collect a sample of water, juice or mashed vegetable leaf and place the chemical-based detection chip in with the sample. A summer high-school student in He's food science laboratory developed a simple smartphone app that visually detects bacteria in samples that contain the chip. "This is just the beginning of the work," says He. She hopes to receive more funding to continue this practical application.

## Ferrero acquires Nestlé's US confectionery business for \$2.8bn

### MERGER

FERRERO'S conquest of the US confectionery market has continued with its third acquisition of an American sweet business in less than a year as it acquired Nestlé's US confectionery business for \$2.8bn.

Through the purchase, the Italian company has become the third largest confectionery company in the US, close behind Mars and Hershey. Ferrero will acquire more than 20 American brands, including Butterfinger, BabyRuth, 100Grand, Raisinets, Wonka, and the exclusive right to the Crunch brand for confectionery and certain categories in the US, as well as sugar brands such as SweeTarts, LaffyTaffy, and Nerds. In 2016, these brands netted Nestlé approximately \$900m, or around 3% of the group's total sales.

Ferrero will acquire Nestlé's US manufacturing facilities in Bloomington, Franklin Park and Itasca, Illinois, and the confectionery-related employees, and will continue to operate through the offices in Glendale, California, as well as from its other current locations in Illinois and New Jersey.

Giovanni Ferrero, Executive Chairman of the Ferrero Group, said: "We are very excited about the acquisition of Nestlé's US confectionery business, which has an outstanding portfolio of iconic brands with rich histories and tremendous awareness. In combination with Ferrero's existing US presence, including the recently acquired Fannie May Confections Brands and the Ferrara Candy Company, we will have substantially greater scale, a broader offering of high-quality products to customers across the chocolate snack, sugar confectionery and seasonal categories, and exciting new growth opportunities in the world's largest confectionery market."

Mark Jones, Food and Drink Lawyer at Gordons law firm, said: "Nestlé's sale of its US business has been coming for a few years. The surprise is the price Ferrero is paying, which estimates suggest is around 20 times multiple of earnings – which is high given the reason Nestlé is selling is that the chocolate market isn't seeing the historical year-on-year growth it became accustomed to."

## Salmon farmers set up 'unique fingerprint' to fight food fraud

### SUPPLY CHAIN

A SALMON farming company has joined forces with traceability experts, creating unique fingerprints to verify the origin of their fish.

Loch Duart, an independent salmon farming company based in Sutherland and the Hebrides, is taking the fight to food fraudsters to protect the reputation of its world-renowned salmon. The business has teamed up with Oritain, experts in scientifically proving the origin of food products, to prevent food fraudsters from passing off other salmon as Loch Duart's.

Oritain's testing measures trace elements that occur naturally at each farm and are absorbed by the fish raised there. Further analysis creates a unique fingerprint that is then used to verify the origin of the fish.

It is estimated that food fraud affects at least 10% of the global food supply chain at a cost to the industry in excess of \$50bn per year.

From 2018, Oritain will provide Loch Duart with this independent food fingerprinting service, with its origins in forensic science, to help protect its brand. This means that Loch Duart will be able to audit at any stage in the supply chain and determine exactly where the salmon being tested originates from. Loch Duart will be first fish farmer in the northern hemisphere to use this technology.



Alban Denton, Managing Director of Loch Duart, said: "Loch Duart's really proud of our extraordinary tasting salmon which is asked for by name worldwide. If another salmon is 'passed off' as ours, consumers are being both exploited and misled. Our distributors have told us that it happens, now we're partnering with Oritain to 'police' the supply chain. We're determined to do everything we can to protect our world-renowned brand and ensure that when people ask for Loch Duart salmon they can be completely certain this is what they are getting."





## Leading the way in sustainability

*Dr Judith Bryans*, Chief Executive, Dairy UK

WHETHER farmer, processor or consumer, creating a more sustainable planet is in everyone's interest. British consumers are increasingly interested in what they are eating and where it comes from. In the dairy industry we have long recognised that our sustainability is fundamental to protecting food security and ensuring the long-term future of the sector.

Collaborating with other industry bodies and government departments has been key to our success. It has enabled us to become leaders on environmental commitment in the wider agri-food sector, through cross-industry initiatives such as The Dairy Roadmap, working with the NFU and AHDB Dairy, we have brought together the supply chain to set targets which address our environmental footprint. Now entering its 10th year, The Dairy Roadmap is helping the industry to set new targets and evaluate progress, whilst providing a template of best practice and collaboration for others across the globe. Working with WRAP, we are also signatories to the Courtauld Commitment 2025, pledging to play our part in reducing the resources required in the dairy supply chain.

We will continue to engage with government and decision makers on schemes like the Food and Drink Sector Decarbonisation and Energy Efficiency Plan and, following the publication of the government's 25 Year Environment Plan, we are also looking forward to future collaboration to help solve emerging environmental challenges – namely the impacts of plastic and other packaging.

The scale of the challenges we face is such that we must address them by working with our global counterparts. Working with the International Dairy Federation and the European Dairy Association we can create a network of knowledge and expertise that we can call upon to recognise, take account of, and solve sustainability challenges. The IDF working with the FAO has pioneered a unified approach to sustainability through the Dairy Declaration of Rotterdam.



**DR JUDITH BRYANS** is the Chief Executive of Dairy UK. Prior to that she was Director of The Dairy Council. Dr Bryans is also President of the International Dairy Federation and has chaired the IDF Standing Committee on Nutrition and Health. She sits on the board of the European Dairy Association (EDA) and chairs the EDA Scientific Advisory Board: Dairy, Nutrition and Health. In the UK, Dr Bryans is a board member of organisations including The Dairy Council, Dairy Energy Savings and the Milk Marketing Forum.

In signing the Dairy Declaration, Dairy UK has pledged commitment to the UN 2030 Sustainable Development Goals and recognised the role of dairy in driving sustainable practices worldwide. The declaration creates a credible and authoritative commitment from the industry to create a sustainable dairy industry worldwide. We are also affiliates of the Dairy Sustainability Framework, a global consortium of industry which seeks solutions to common sustainability issues through collaboration, sharing of information and partnerships, using indicators against which members report.

Monitoring and reporting on key sustainability metrics is a key part of evaluating our performance. We must be evidence-led in our actions and objectives and continually improve. Results from our recent environmental benchmarking report at the end of 2017 demonstrated just how far we have come as an industry, with an 18% increase in primary energy efficiency, a 23% increase in water efficiency, a 17.5% increase in raw effluent efficiency, a 56% decrease in COD per m3 raw effluent, and a 30% shift in the destination of waste away from landfill and towards recovery or recycling. These improvements not only surpassed the targets the industry set itself, but also mean that the sector has already exceeded the 2020 Climate Change Agreement and Dairy Roadmap targets of 13.6% and 15% respectively.

Developments in new technologies and reporting procedures have allowed us to show the great strides we have made in efficiency and reducing our environmental footprint. While we should be proud of what we have achieved so far, it is important that this does not breed complacency – there is always room for improvement. Innovation, collaboration and adaptability will be key to creating the sustainable dairy industry of the future, and despite past successes we must remain proactive and committed to achieving this. I hope we inspire other sectors with our results, and demonstrate what can be achieved with focus and determination. 



# The Sins of Seafood

With seafood and aquaculture being the most valuable and highest traded commodity in the world, it's an industry which inevitably is the most susceptible to fraud. With one in five out of 25,000 samples tested worldwide being mislabelled, fraud comes in many forms and is often referred to as the 'Sins of Seafood', following the Elliott Report of 2014.



FRAUD negatively impacts food safety, quality, sustainability and our environment. Throughout this webinar, sponsored by Agilent and broadcast live on 23 January, Professor Chris Elliott, Professor of Food Safety and Director of the Institute for Global Food Security, Queen's University Belfast, explored these sins and discussed how analytical science tries to detect, and ultimately deter, these frauds from occurring.

Here are a selection of questions posed by webinar attendees, along with Prof Elliott's answers:

## What impact do you think the Government's National Food Crime Unit will have on food fraud in the UK?

This came about as a result of one of the recommendations in the report that I wrote for the UK Government in terms of deterring criminal activity in food supply systems. The National Food Crime Unit has been up and running for a number of years and the staff that work in it are fantastic. Some come from a law

enforcement background, some come from a food background. But these types of regulatory body needs to be well resourced. That's true not only in the UK – we need dedicated people to fight food crime in different parts of the world.

## As a consumer, is there anything I can do to protect myself from food fraud?

It's very difficult because even in European law it's enshrined that food businesses must protect us in terms of food safety. I think that's equally true about food fraud. Buying local is best but in terms of seafood that's very difficult. So we often have to put our trust in who we're buying our food from.

## Can you touch on quick DNA methods for species detection?

There are lots of ways that DNA can be used. There are some very elaborate and nice workflows that can be used to detect multiple species of fish. There are also some very low-cost handheld



technologies being developed that might be very useful in the future.

## Do hormone stressors and catch methods affect isotopes?

We found that we could determine the catch method using our fingerprinting technique. My research group are currently trying to discover the triggers behind that and one of our hypotheses is that it's due to different stress mechanisms in the fish. This is something we are actively exploring at the moment.

## Which country has the most robust anti-fraud laws for food?

Very few parts of the world have really been able to tackle food fraud. But because of the massive issues that occurred in China in terms of melamine and because of the issues we've had in Europe there's been a massive amount of work been done in those two continents. But there's a huge amount of work still to be done. 

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# Chemical decontamination of poultry: time for a think?

As Brexit looms, thoughts are turning to what it might mean for food safety in the UK. The 'poster boy' for this issue seems to be the vexed question as to whether poultry should be permitted to be 'washed in chlorine' to improve microbiological food safety. **Andrew Hudson**, of Jorvik Food and Environmental Microbiology, considers the pros and cons of chlorine-washed chicken.

**W**ASHING chicken in chlorine is one of a small number of interventions that the Americans use in their industry, but it and the other interventions are not permitted in the EU. So, is this approach to food safety control a viable option for the UK post-Brexit once we have 'taken back control'? After all, chlorine-based chemicals have been used to treat drinking water to the immense benefit of public health for many years and they are also used in the disinfection of fruits and vegetables.

Most opinion regarding the suggestion seems to be negative, with many claiming that chlorine washes (taken to be representative of the possible interventions) are used for the sole purpose of camouflaging poor practice at steps in the food

chain before the wash. Dangers are identified to both the consumer and process workers – and these dangers are potentially real. Such hazards include the formation of by-products such as semicarbazide, which is a carcinogen, and exposure of meat processing workers to peracetic acid (one of the other disinfectants). The arguments can be read in detail in a short paper published by the Food Research Consortium.<sup>1</sup>

Given the nature of the debate, there is a need to consider the difference between 'hazard' and 'risk'. To draw an analogy with everyday life, the most significant hazard associated with the next plane journey you take is that the plane will crash and kill you (a hazard in the same respect that a food is a chemical, microbe or physical object that can cause injury or illness). However, millions of people

## ABOUT THE AUTHOR



**ANDREW HUDSON** is a Fellow of the Institute of Food Science and Technology. He has a BSc (Hons) from Bristol University and a doctorate from New Zealand's University of Waikato. Dr Hudson has published more than 90 peer-reviewed papers, reviews and book chapters. He currently works at Jorvik Food and Environmental Microbiology.



still make plane journeys every year as they believe that the 'risk', which is a function of exposure to the hazard and the probability of consequent injurious effect, is low and acceptable. Despite the severity of the hazard, the risk associated with the flight is outweighed by the benefit of taking it.

OK, so the UK is producing chicken without a chlorine wash and minimising any of the associated chemical risks. But what about the other side of the equation? Are the other combined controls achieving chicken production that is acceptably safe from a microbiological perspective? The latest figures from the Food Standards Agency's (FSA's) campylobacter in poultry surveillance programme provide some information. While the prevalence of contaminated neck flaps (taken to represent carcasses) is apparently decreasing, it is still more than 50%: to be precise, 54% of the 3,980 samples tested. Samples containing >1000 CFU/g of campylobacter were found to represent 6.5% of the total.

### Implications for foodborne disease


The next question would be to ask what the implications are for foodborne disease. It can be difficult to tease apart the contribution that any one food makes to the overall picture of a single foodborne disease because humans are exposed to campylobacter from a number of sources such as raw milk/dairy products, contaminated water, liver, and direct contact with ruminant animals. Nevertheless, it is well accepted that the handling of uncooked chicken and the consumption of undercooked chicken contribute the lion's share of campylobacteriosis cases in developed countries.

In the UK, the FSA provides the following statistics for campylobacteriosis:<sup>2</sup>

- Campylobacter is considered to be responsible for more than 280,000 cases of food poisoning each year
- There are more than 72,000 laboratory-confirmed cases of campylobacter (sic) poisoning
- Estimates have indicated that campylobacter causes more than 100 deaths a year
- Campylobacter costs the UK economy about £900m
- About four in five cases of campylobacter poisoning in the UK result from contaminated poultry.

While this information is now quite dated – and numbers may have decreased – they are still high. Are these numbers acceptable? What would be the effect of a chlorine treatment and would the benefits (ie, reduction of microbiological risk) outweigh the potential increase in chemical risks?



 **ABOVE:** *Campylobacter jejuni* bacteria


We might be able to take some pointers from New Zealand, which has similar issues with campylobacteriosis. It is also a country where most of the poultry is 'chlorine washed' in giant spin chillers at the end of processing.<sup>3</sup>

The average incidence of campylobacteriosis in New Zealand was 353.8/100,000 population for 2002-2006, but by 2008 it had been reduced by 54% to 161.5/100,000 (which is still high compared to other countries as it was 66.3 in the EU and 90.4 in the UK in 2016, and 13.0 in the USA in 2015) following a number of interventions by the poultry industry, one of which was improving the control of conditions in the spin chillers, ie, ensuring that the concentration of chlorine was maintained at a level that was effective.

Although it is not clear what proportion of the reduction of disease incidence was the result of improved spin chiller conditions, it was identified as one of the key interventions.<sup>4</sup> It is not possible to conclude outright that implementing such an approach in the UK would result in such a significant reduction in campylobacteriosis, but it is arguably worth a thought and not to be dismissed out of hand.

Here we have a typical 'swings and roundabouts' situation, but who balances the risks of a chlorine wash against the benefits accruing from reducing the number of cases of campylobacteriosis? It is no longer acceptable to view the world from a hazard-based perspective; there is a need to follow a risk-based approach which, as far as I can tell, is largely absent in this debate.

### Acknowledgement

I would like to acknowledge the input of John Bassett, of John Bassett Consulting Ltd, for constructive comments on the original draft. 

**“It can be difficult to tease apart the contribution that any one food makes to the overall picture of a single foodborne disease”**

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# PROCESSING

Maintaining standards in meat processing: David Lindars, Technical Policy Advisor at the British Meat Processors Association (BMPA), explains how standards for British pork are assured.

Although workplace injuries in the food and drink manufacturing sector have been reduced by 60% since 1990, the injury rate is still more than double the average for the manufacturing sector as whole. HSE Inspector Warren Pennington tells *New Food* Editor Steve Bremer about initiatives to improve workplace safety.



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A photograph of several white piglets in a field. The piglets are looking towards the camera, and their ears are prominent. The background is slightly blurred, showing more piglets and some greenery.

## Maintaining standards in meat processing

*David Lindars*, Technical Policy Advisor at the British Meat Processors Association (BMPA), explains how standards for British pork are assured.

**T**HE UK meat industry has seen huge change over the last 20 years, driven by European Union legislation changes and the updating of various standards.

One of the main drivers of standards has been the BRC (British Retail Consortium), which is currently working its way through the draft of Issue 8 of its Global Standard for Food Safety. BRC committee members are drawn from a wide variety of sectors, such as industry, trade associations and retailers.

When a business is audited against this standard it is safe to say that it's no walk in the park and

can take up to two days. The auditor will seek to challenge the site's systems, wanting to see objective evidence that their systems are working and, more importantly, managing risks.

Assured Food Standards (AFS) owns the Red Tractor Assurance scheme, under which the majority of UK cattle, sheep and pigs are processed. This supply chain is audited against the AFS standard, which is also subject to a review process that is revised by industry groups. There are also several other schemes in the UK that are accredited under UKAS (United Kingdom Accreditation



FIGURE 1

← LEFT: The BMAP  
Pork Scheme



Service), which is recognised by government to assess against internationally agreed standards organisations that provide certification, testing, inspection and calibration services. UKAS sets rigorous standards which the badge holder is audited against to ensure compliance. It also assures that the checks and balances the holder has in place are working and creditable.

### The BMAP Pork Scheme

The British Meat Processors Association (BMAP) Pork Scheme standard provides quality assurance to retailers and consumers about pig welfare, food safety, integrity, provenance and traceability of the products that its members produce. The scheme represents the standard that sits behind the widely recognised and trusted Red Tractor consumer logo for pork and pork products. For many of the UK's top retailers and food service companies our standard is the one they insist on from their pork product suppliers. The path of assurance in the British meat industry is an unbroken, quality-assured chain of farmers, abattoirs, processors and manufacturers of pork and pork products.

Membership of the BMAP Pork Scheme is so widely demanded because the requirements go above and beyond those of current legislation and set a higher benchmark for product quality

and integrity. Buyers are confident in the knowledge that our scheme's members work to higher standards and have been audited by independent UKAS- and ISO-accredited certification bodies.

Attaining assurance through the scheme not only allows manufacturers to prove they operate to best practice standards, but often acts as a ticket into a much wider market for their products amongst the larger retailers and food service buyers. Members can also display the Red Tractor logo on their products by applying to AFS for a licence.

The BMAP Pork Scheme modules form the backbone of our internationally recognised standard (Figure 1). In order to qualify for the scheme, members must be certified in the core (fresh pork) standards, plus any individual additional modules that apply to their particular products.

### The core standards

These are general industry standards that all abattoirs, processors and manufacturers are expected to adhere to. There are numerous assurance schemes that BMAP recognises, such as the BRC Global Standard (food safety, storage and distribution), Red Tractor, and Quality Meat Scotland, among others.

**Module 1: Pig Welfare and Slaughter** deals with all aspects of pig sourcing from assured farms, ▶

**“Membership of the BMAP Pork Scheme is so widely demanded because the requirements go above and beyond those of current legislation and set a higher benchmark for product quality and integrity”**



**“The path of assurance in the British meat industry is an unbroken, quality-assured chain of farmers, abattoirs, processors and manufacturers of pork and pork products”**

biosecurity during transportation (lorry washing), as well as animal welfare during unloading and slaughter.

**Module 2: Quality Assured Pork** covers pork supplies, the receiving of pork into processing plants, temperature controls and storage. It also deals with processing standards, traceability and mass balance, along with standards for finished products.

**Module 3: Bacon** covers bacon supplies, the receiving of pork and bacon into processing plants, temperature controls and storage. It also deals with processing standards, traceability and mass balance, along with standards for finished products.

**Module 4: Ham and Cooked Pork** covers ham and cooked pork supplies, the receiving of pork and ham into processing plants, temperature controls and storage. It also deals with processing standards, traceability and mass balance, along with standards for finished products.

**Module 5: Pork Sausage** covers pork sausage supplies, the receiving of pork into processing plants, temperature controls and storage. It also deals with processing standards, traceability and mass balance along with standards for finished products.

Participants do not have to be members of the BMPA, the scheme is open to any meat business in the UK, however non-members pay slightly more per licence. The standards are wholly owned and managed by the BMPA and are also UKAS accredited.

Scheme participants undergo announced and unannounced surveillance audits carried out by BMPA approved auditors, who are required to have accreditation to the international standard for bodies certifying products, processes and services (ISO 17065) assessed by UKAS. They must


also provide an assurance of the competence, impartiality and integrity of conformity assessment bodies.

Membership of the BMPA Pork Scheme is subject to the successful completion of an initial approval audit, annual announced surveillance audit, unannounced surveillance audit and, where deemed necessary, spot check audits (either announced or unannounced) if requested by the BMPA.

### Tracking the supply chain

The British Pig Executive (BPEX) stable isotope reference analysis (SIRA) test allows the country of origin of pork bearing the Union Jack flag, the Red Tractor logo, or which is described as British, to be established. The scheme is reviewed in line with our UKAS accreditation and is currently undergoing an interim review. The last consultation with interested parties concludes on 1 March, and the release date is 2 April 2018.

Other checks and balances that the meat industry is using include blockchain and DNA sampling. Arc-net, for example, tracks products through the supply chain using the technology that powers bitcoin and other cryptocurrencies for food and drink producers, such as Cranswick, the listed pork group, and Ireland Craft Beers. Animals are given a DNA tag, which forms the start of the blockchain. Any information regarding veterinary issues, animal feed, movement between farms, etc, is added to the ledger.

DNA sampling allows food retailers, processors and producers to identify and trace the source of protein products throughout the entire supply chain. This advanced level of supply chain transparency enables food businesses to source with integrity and provides value-added assurance for consumers. 

### ABOUT THE AUTHOR



**DAVID LINDARS** is Technical Policy Advisor at the British Meat Processors Association.



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## Towards a safer workplace

Workplace injuries in the food and drink manufacturing sector have been reduced by 60% since 1990, and there have been considerable improvements in tackling ill health caused by work. But the injury rate is still more than double the average for the manufacturing sector as whole. HSE Inspector **Warren Pennington** tells *New Food* Editor Steve Bremer about initiatives to improve workplace safety.

**O**N AVERAGE, 27 workers are killed each year in the manufacturing sector as a whole, accounting for almost 20% of all workplace fatalities. The fatal injury rate is higher than the all-industry average, with main causes being struck by objects, fall from height and contact with machinery. The main causes of manufacturing workplace injuries are lifting, handling, slips, trips and falls.

'A Recipe for safety' was a successful joint initiative between the main food and drink trade

associations, unions and the Health and Safety Executive (HSE) that was launched in the early 1990s to reduce injuries and ill health caused by work in food and drink manufacturing. Originally overseen by the Food and Drink Manufacture Health and Safety Forum, the latest version can be downloaded free.<sup>1</sup>

Recipe for Safety has contributed to safety improvements in the sector, but the situation is currently not improving as fast as the HSE would like, says Mr Pennington. The food sector injury rates in 2014/15 fell 11% compared to the previous year, but the sector's 2015/16 injury rate only fell 2% compared to 2014/15 (compared to the 5% reduction achieved by the manufacturing sector as a whole).

Injury rates across the 30 food and drink manufacturing sectors (bakeries, meat processing,

**“Positive steps by management could have prevented injury in about 70% of incidents”**



dairies, etc) vary considerably, with some sectors well above the food and drink industries average and many well below. Even within these sectors injury rates and health and safety performance vary from company to company.

Food processing is a high-risk sector to work in, with potential hazards arising from many sources such as transport, machinery, hazardous substances, use of knives, etc. A lot of 'hot' and 'cold' processes and significant cleaning requirements add to the risks. Manual handling and slips, trips and falls are very big issues. In particular, the food and drink manufacturing industry needs to raise its game in managing these areas, says Mr Pennington. Manufacturers should read Recipe for Safety to understand the sources of risk. They should then ensure that they give resources to implementing adequate control measures, to training employees on such and to undertaking monitoring to ensure controls remain effective.

### Why positive action is needed

HSE research indicates that positive steps by management could have prevented injury in about 70% of incidents, and action by workers a further 10%. Effective management of work-related safety and health is good for business. Many companies have embedded this argument in the development of their health and safety policies and culture.

The added value comes from both ends of the balance sheet – reduced costs as well as higher efficiencies, productivity and profit. It is not just about the cost of claims and replacement labour, it is about the whole economic well-being of the business, as well as trust and reputation.

Health and safety failures can be costly and hidden costs may include:

- Equipment or process damage / downtime
- Loss of production
- Absence of key workers due to injury or ill health
- Additional training costs
- Additional overtime
- Loss of reputation
- Management time and resources for investigation
- Increasing employers' liability insurance costs.

All too often insufficient focus is given to ill health caused by work that can often lead to long-term or permanent damage. The main causes of occupational ill health in the food and drink industries include:

- Musculoskeletal disorders (MSDs) – mainly comprising work-related upper limb disorders (ULDs) and back injuries ➤

## EXPERT VIEW



**Roman Murcek**  
MCD Project Manager,  
Fraunhofer IVV

# Don't give residue and contamination a chance

Present-day cleaning processes often waste time and resources. Automated systems can deliver non-contact, intelligent and targeted cleaning, and allow for better efficiency validation.

Fraunhofer IVV Dresden is developing a mobile cleaning device (MCD) that, thanks to its optical sensor system for detecting soiling, can identify cleaning requirements, determine the relevant parameters for need-based and efficient cleaning, and then carry them out autonomously. The MCD is moved through the installation on the system conveyor belt, merging the flexibility of manual cleaning with the benefits of reproducible automated clean-in-place (CIP) processes to save time and resources while increasing process reproducibility – all with the help of Baumer sensors and industrial cameras.

The MCD features seven nozzles which, depending on type and degree of contamination, blast cleaning media such as water or foam at a pressure of up to 10 bar and follows the product route on the machine's existing transport system. A self-propelled system, with the help of either an additional self-propelled module or directly-mounted motors and wheels, has been designed for other cleaning tasks without a conveyor belt. While moving, the MCD emits UV light to detect fluorescent organic dirt particles such as grease residue with the aid of a camera.

Specialised design provides great flexibility for use in various systems and is more efficient and reliable than manual cleaning. It can reach spots inaccessible by manual cleaning without the need to disassemble any machine parts, and tests have yielded cleaning media savings of about 20% compared to conventional CIP cleaning systems. Plus, integrated image processing ensures consistent quality assurance and documentation of the cleaning process.

The MCD is under continuous development at Fraunhofer IVV. The current version operates on defined process flow, but research is considering completely autonomous control via a virtual twin of the cleaning installation as well as the software integration of the cleaning sensor system. Supported by virtual twin simulations, the MCD would be able to determine the cleaning parameters all by itself. ■



**Food processing is a high-risk sector to work in**

- Work-related stress – which can be caused by poor work organisation
- Asthma – for example from inhalation of flour and grain dusts
- Dermatitis – from hand washing, contact with foodstuffs, chemicals, etc
- Noise-induced hearing loss – where noise levels exceed 80 decibels (dB).

#### ABOUT THE AUTHOR



**WARREN PENNINGTON** is Her Majesty's Inspector of Health and Safety at HSE, and administrator of the Food and Drink Manufacture Health and Safety Forum.

Machinery and plant accounts for a third of all fatalities in the food and drink industries, making it the highest cause of fatalities. Machinery also accounts for a significant proportion of non-fatal injuries – in 75% of cases there was no or inadequate guarding and in 25% of cases cleaning was taking place.

#### Targeted inspections

HSE targets high-risk sectors for its inspections each quarter and it was planning up to 1,000 visits to food and drink factors between January and March 2018. These were to focus on the issues identified in the Manufacturing Sector Plan<sup>2</sup> and in the HSE Health and Work Strategy.<sup>3</sup> Therefore, visits were to focus on two of the main causes of ill-health in the sector: occupational asthma from exposure to flour dust in bakeries, cake and biscuit manufacturers and grain mills; and musculoskeletal disorders (MSDs) – predominantly lower back pain and upper limb disorders from manual handling activities and repetitive tasks across the sector.

HSE carried out 1,264 inspections of food and drink manufacturing premises last year and its inspectors found a 'material breach' in 44% of those visits, which triggered a Notice of Contravention letter. HSE has a total of 4,528 food manufacturing premises and 608 drink manufacturing premises on its database.

If an HSE inspector identifies a serious issue requiring more urgent attention, they can issue an Improvement Notice, with which the company has 21 days to comply. A more serious Prohibition Notice

can require the immediate cessation of a dangerous practice such as someone lifting an excessive load, or someone working on an unguarded machine. HSE served 458 enforcement notices on food and drink manufacturing companies last year, of which 410 were Improvement Notices and 48 were Prohibition Notices.

Prosecution is the final step, and the HSE made 19 prosecutions in 2016/17: 12 for machinery issues; five for falls from heights, one related to gas safety, and one was for non-compliance with an Improvement Notice. Total fines increased last year to £4,751,573, from £2,530,000 the previous year.

#### A common safety strategy

The Food and Drink Manufacture Health and Safety Forum comprises the main food and drink trade associations and trades unions along with representatives from HSE's Food and Drink Manufacture Section. It meets to discuss the best ways to further reduce injuries and occupational ill health in the food and drink manufacturing industries and encourages member organisations to adopt, promote and support best practice and initiatives that it has agreed.

Member organisations of the Forum launched its revised 'Common strategy' in November 2016,<sup>4</sup> setting out the actions each party will undertake to further reduce injuries and occupational ill health. This builds on the work that has been done under the Recipe for Safety campaign, and sets out four key objectives:

- To reduce HSE Reporting of Injuries, Diseases and Dangerous Occurrences (RIDDOR) ill health and injury by 10% per year over the next five years
- To reduce musculoskeletal disorders from manual handling and repetitive work
- To reduce slipping and tripping injuries
- To control work-related ill health through proper occupational health management.

#### FACTS:

96% of all injuries and occupational ill health in food and drink manufacture are caused by the following:

- Machinery
- Workplace transport
- Work at height
- Entry into silos and confined spaces
- Slips and trips
- Struck by objects and knives
- Manual handling
- Upper limb disorders
- Occupational dermatitis
- Occupational asthma
- Noise-induced hearing loss
- Work-related stress

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# Food Fraud

## Food Fraud 2018: the genuine article



1 MARCH 2018



LONDON, UK

Returning for a second edition, *New Food's* hugely successful **Food Fraud** conference is coming to London on 1 March. Food fraud loses the food and beverage industry up to £12bn annually. The time has come to connect the industry and collaborate to eradicate the problem.

THIS YEAR'S Food Fraud programme adopts an international stance, combining panel discussions, case studies, spotlight focuses and presentations. The day provides delegates the opportunity to witness state-of-the-art technology demonstrations and affords ample time for questions and discussion. An extensive yet concise programme enables attendees to gain a thorough insight into current issues as well as plans to address them.

Chaired once again by Professor Chris Elliott, Queen's University Belfast, and co-chaired by Helen Sisson, Greencore Group and Food Industry Intelligence Network (FIIN), the Food Fraud 2018 speakers are all experts in their field and bring a wealth of industry knowledge to the conference.

### Sessions include:

- Assessing industry progress and how to move the food industry forward
- The global effort to combat food fraud: what is being done and how will it impact domestic businesses?
- Identifying food fraud through supply chain mapping and analysis
- Examining the latest approach to enforcement and regulation in the UK and beyond



"Food and drink is a £200bn industry and like any industry it is vulnerable to criminal activity. Like any other form of criminality, law enforcement can only combat this threat in collaboration with those who are at risk, and a big part of that is liaising with industry groups to really understand their business and where those threats can come from"

Gavan Wafer, National Food Crime Unit

## ADVANCES IN MS WITH WATERS

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WATERS Corporation will be at Food Fraud 2018, where you will be able to hear about the latest advances in mass spectrometry as applied to food fraud and authenticity. Dr Sara Stead, Principle Scientist MS Technologies, will present 'Direct mass spectrometry with chemometric modelling: two solutions for the food testing industry'.

The use of two direct mass spectrometric techniques – rapid evaporative ionisation MS (REIMS) and direct analysis in real time (DART) – can, when combined with chemometric modelling, be used as a

solution for the food testing industry and potentially for automated at-line testing. Applications have been developed to address food quality, grading and composition testing, the detection of undeclared ingredients in processed foods and authenticity verification.

On the exhibition booth, you will be able to experience demos of the latest softwares LiveID and Progenesis QI, and interact with the Waters' scientists to discover the latest application developments. We look forward to meeting you at Food Fraud 2018.



A man with curly hair, wearing a blue apron over a grey t-shirt, is smiling and feeding a young boy with a spoon. The boy is also smiling and has his mouth open. They are in a kitchen setting with a stove and pots in the background.

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Do you want to increase the confidence in all your food testing analytical results? Come and visit Thermo Fisher Scientific at booths one and two at Food Fraud 2018.



Professor Chris Elliott, of Queen's University Belfast, will chair Food Fraud 2018

- Cost effective and simple tools for fraud prevention
- Horizon scanning and testing: becoming a world leader
- The seven sins of seafood
- How can audits and testing unite to create a single coherent anti-fraud strategy?
- Blockchain – improving global traceability.

#### Speakers include:

- **Professor Samuel Godefroy**, Full Professor of Food Risk Analysis and Regulatory Systems, Department of Food Science, Faculty of Agriculture

and Food Sciences, Université Laval, Quebec, Canada

- **Petter Olsen**, Senior Scientist, NOFIMA
- **Gavan Wafer**, Head of Intelligence, National Food Crime Unit, Food Standards Agency
- **Ron McNaughton**, Head of the Scottish Food Crime and Incidents Unit, Food Standards Scotland
- **Mariah D Ehmke**, Associate Professor, Department of Agricultural and Applied Economics, University of Wyoming
- **Professor Dr Huub Lelieveld**, President, Global Harmonization Initiative

- **David Primrose**, Director, Synergy Food Ingredients
- **David Oliver**, Head of Technical, Co-op
- **Stephen Shields**, Technical Director, Huntapac Produce Ltd
- **Shane McCarthy**, CEO, Ireland Craft Beers
- **Matthew Rymer**, Founder, Happerley
- **Tomi Helin**, Materials Manager, Valio, Finland.

The Food Fraud 2018 conference will reunite food manufacturers, supermarkets, processors, suppliers, technology companies and academia, to share best practice, lessons learned and prevention and detection methods. As a delegate, you will be able to meet industry leaders against the backdrop of a fantastic networking and business opportunity. Confirmed attending organisations include: 2 Sisters Food Group, Allianz, Food Standards Agency, Marks & Spencer, Marsh, Sainsbury's, Premier Food Group, Unilever and PepsiCo. ■



"With focus on food crime (ie, fraud that affects the safety of the food), authorities and individual food professionals need to realise that understanding and international cooperation is essential to bring matters under control"

Huub Lelieveld, Global Harmonization Initiative

**For further information, including a view of the programme, learning about sponsorship opportunities and how to book your place, please visit: [newfoodfraud.com](http://newfoodfraud.com)**



# Safety and quality in food testing

The role of food testing laboratories has never been more critical. Safety and quality are of major concern to consumers, governments, and food producers. These groups face a variety of challenges, including a growing number of food contaminants, more stringent regulations, protection of trade markets, preservation of brand image, and increased competition.

WATERS is a leader in developing food testing systems that integrate column and sample prep chemistries, analytical instrumentation and data management software. Waters' comprehensive solutions enable food laboratories to identify diverse chemical compounds, meet compliance requirements, decrease operation costs, increase productivity, and, most importantly, help ensure public safety.

During the Food Fraud Conference on 1 March, Sara Stead, Principal Scientist, MS Technologies at Waters, will be speaking about 'Direct MS with chemometric modelling – two solutions for the food testing industry'. The use of two direct mass spectrometric techniques – rapid evaporative ionisation MS (REIMS) and direct analysis in real time (DART) can, when combined with chemometric modelling, be used as a solution for the food testing industry and potentially for automated at-line testing. Applications have been developed to address food quality, grading and composition testing, the detection of undeclared ingredients in processed foods and authenticity verification.

Sara has worked in the area of food and environmental analysis focusing on the detection of chemical residues and natural contaminants for the past 18 years in both the government and private sectors. Sara was employed as a senior scientist at the Food and Environment Research Agency (FERA, Defra, UK) for 13 years and was responsible for leading a group of scientists focused on the development and validation of methods for analysis of food and feedstuffs and providing advice to the industry. Sara has participated in EU Food and Veterinary Office (FVO) audit inspections acting as the independent laboratory expert, been a short-term expert delivering training on behalf of the International Atomic Energy Agency (IAEA), and is a member of the EuroResidue



conference scientific committee. Sara has acted at Work Leader and Deputy Work Package Leader level responsible for the delivery and reporting of various EU-funded (FP7) collaborative projects, including ISOSTER, BioCop and CONFIDENCE.

In 2011, Sara joined Waters as Strategic Market Development Manager within the worldwide food and environment team. She has extensive experience of working with customers and key opinion leaders and has a keen understanding of the current and future analytical requirements within the food and environmental testing sector. Sara maintains an excellent network of senior level key opinion leaders and collaborators within the international food and environmental analytical and industrial sectors.

Sara has a number of research and application interests, including the

development of both multi-residue HRMS screening and targeted analytical methods for chemical residues and natural contaminants. Sara is currently involved in the development and positioning of innovative solutions aligned with the food sector requirements using MS-based techniques including REIMS and HRMS, DART-QDa, acoustic wave mist ionisation technology and multivariate statistics.

Join Sara's talk on 1 March and visit her and other food experts at our booth during the conference. ■

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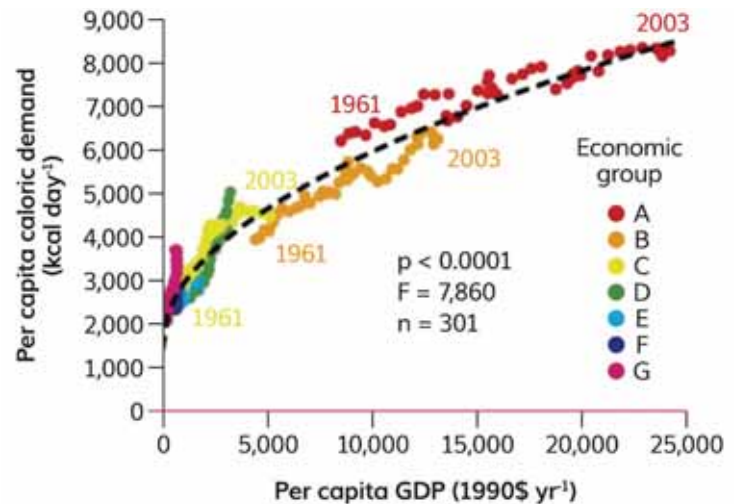
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## Feeding the world: a global challenge

The world is facing a crisis in global food security as the global population increases and diets change with economic development. **Riaz Bhunnoo**, Director of the Global Food Security programme, outlines the key challenges.



FIGURE 1



↑ ABOVE: The relationship between calorie intake and wealth

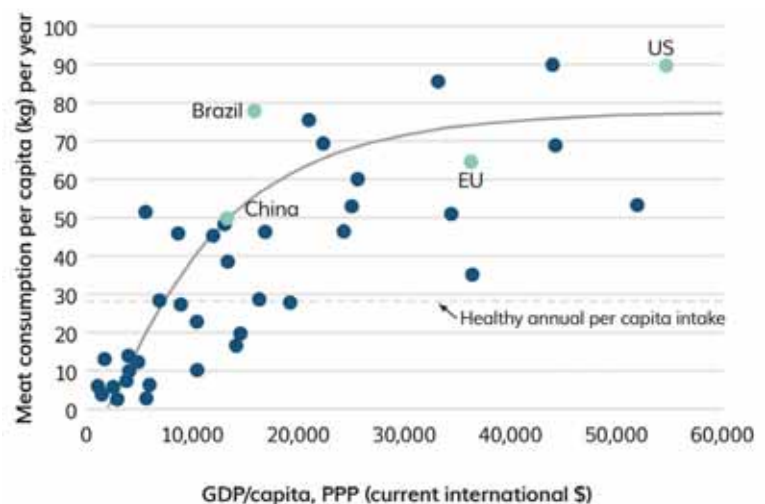
↓ BELOW: The relationship between meat consumption and national wealth

THE population is increasing, meaning more mouths to feed, and it is unlikely that this will stabilise by the end of the century. Recent estimates suggest that the population will rise to 9.7 billion by 2050.<sup>1</sup> At the same time, diets are changing as incomes grow through economic development, which can have positive impacts in helping to lift people out of poverty and improving nutritional outcomes. However, richer people tend to both eat more food<sup>2</sup> and more meat and dairy (Figures 1 and 2), which are resource intensive to produce and can have a higher environmental impact than other food types.<sup>3</sup>

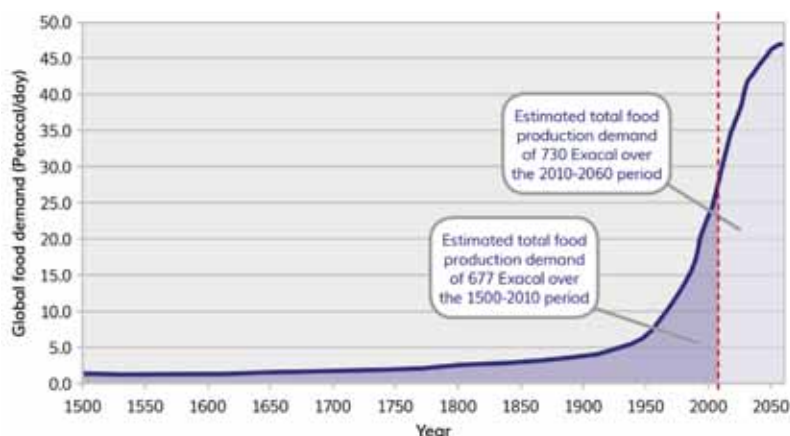
If diets continue as they are, it is estimated that we will need to produce more food in the next 50 years than we have ever produced in human history,<sup>4</sup> (Figure 3) with the Food and Agriculture Organization of the United Nations (UN FAO) projecting that 60% more food will be required by 2050.<sup>5</sup>

However, there are two major externalities not captured by the market that must be acknowledged – the impact on health and the impact on the environment. In terms of health, around one in three people globally suffer from some form of malnutrition – whether hunger, micronutrient-deficiency, overweight or obesity. Recent data suggests that there are now more people in the world who are overweight and obese than underweight, with the two combined accounting for more than half of the world population – a new normal.<sup>6</sup> The trends in the data suggest that is likely to continue over time.

FIGURE 2



**FIGURE 3**



Source: Commonwealth Scientific and Industrial Research Organization (CSIRO).  
A Petocal is  $10^{15}$  calories. An Exacal is  $10^{18}$  calories.

**ABOVE:** Food production over the next 50 years will need to exceed that to date



also requires net global emissions to reach zero by 2040-2060.<sup>8</sup>

This implies sustainable intensification of agriculture on existing land – producing as much as we can in the most sustainable way. However, even if we are able to close yield gaps we still need 56% more water, 5% more land, the loss of 8% more forest and 42% more greenhouse gas emissions. Clearing rainforest or natural landscapes is not desirable because it leads to biodiversity loss and more emissions. It is therefore clear that sustainable intensification on its own will not be sufficient – demand-side measures on consumption and waste will also be required.

**BELOW:** The mismatch between food production and consumption



## The impact of climate change

Climate change will make it more difficult to meet the food security challenge. Increased CO<sub>2</sub> levels

could increase the rate of photosynthesis and, in turn, yields; however, this has also been associated with a reduction in the nutritional content of crops, including protein and micronutrients such as iron and zinc. This will produce more calories but not necessarily more nutritious foods, which will impact on health. In addition, climate change can alter the distribution and severity of pests and diseases of crops and livestock, and it is estimated that around a quarter of our food production is already lost in this way.

Climate change predictions based on averages can help predict what can be grown and where in the world, and some countries will do better than others. However, these only provide a partial view, and it is the extremes that make up the average temperature and rainfall, such as heatwaves, cold snaps, floods and droughts, that will be challenging.

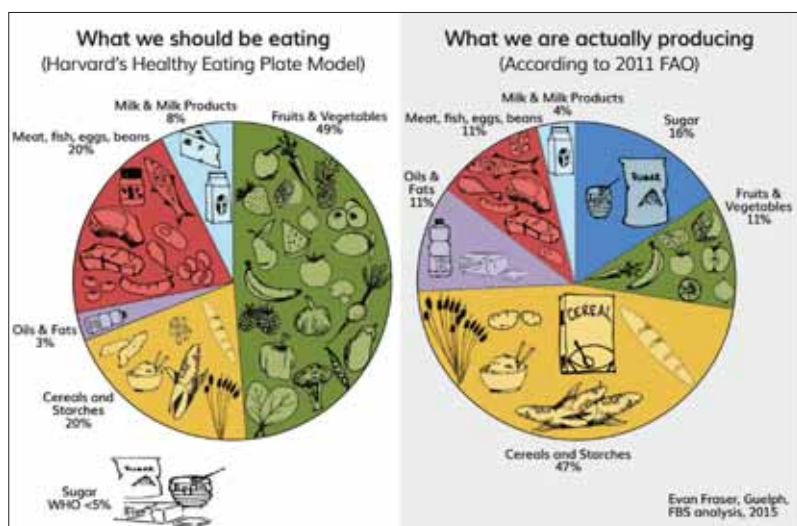
At the Global Food Security programme, our own analysis suggests that the risk of extreme weather hitting several major food-producing regions of the world at the same time could triple by 2040, so that a once in 100 years event could become a once in 30 years event. Climatic shocks do not only lead to a substantive yield loss – the impacts are channelled downstream via market and policy responses, such as export bans, for example, and lead to food price spikes. There is some evidence linking food price volatility and social unrest, and more research is needed on the link between climate change, food security and conflict.

## Growing homogeneity of diets and food production

Our food system is predicated on a small number of commodity crops. Comparative advantage, coupled with a range of policy levers to underpin production, drives the scales and concentration of production so that some areas become 'breadbaskets' for the rest of the world. Globalisation has significant benefits, both in terms of access to food that can be grown more efficiently and cheaply elsewhere, food that may be seasonal but which we want year-round, or food that cannot be grown in a particular country.

One consequence of this is that diets are becoming increasingly similar over time. According to the FAO, just 15 crop plants out of 50,000 provide 90% of the world's calorie intake, with rice, maize and wheat making up two-thirds of this. Large-scale agriculture has undoubtedly improved efficiency and reduced the price of food, but its scale, uniformity and lack of genetic diversity can reduce resilience to pests and diseases and extreme weather. It can also reduce biodiversity through monocultures, and has implications for nutrition, adding to the growing disparity between what we produce in the world and what we should be eating

**FIGURE 4**





as part of a healthy diet (**Figure 4**). This suggests that we should be diversifying both food production and demand, with potential win-win-wins for health, sustainability and resilience.

Global agreements such as the Sustainable Development Goals and the Paris Agreement could be game changing in shaping future food systems. In terms of the latter, one analysis suggests that the food system will likely account for the majority of the carbon budget and a 2°C rise by 2050, if diets continue as they are.<sup>9</sup> Given that the food system accounts for around 30% of all greenhouse gas emissions, it should have a strong role in climate change mitigation. Our work on 'Paris-compliant

healthy food systems' will identify the hotspots for reducing greenhouse gas emissions across the food system that could have simultaneous benefits for nutrition.<sup>10</sup>

The food industry has a significant role to play in making our food healthier and more sustainable. We are already seeing many companies changing their business models and embracing the trends being set by Millennials, who account for around a quarter of our population. Changing attitudes coupled with new technology will lead to a whole host of new food products in future, many plant-based, and with health and sustainability at their core. 

## ABOUT THE AUTHOR



**DR RIAZ BHUNNOO** is Director of the Global Food Security programme. He has worked at the Biotechnology and Biological Sciences Research Council (BBSRC, which formally leads on the multi-partner programme) since 2005, and in that time has undertaken secondments to the Research Councils UK (RCUK) Executive Directorate to work on cross-council research coordination and policy, and the Gates Foundation to work on Grand Challenge Explorations. @RiazGFS

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# Taking mycotoxin control to the next level

THE mycotoxin contamination of various crops and derived products is a global concern because it has significant implications for food and feed safety, food security and international trade. Despite a lot of research and available interventions, mycotoxin prevention and control remain a challenge for agriculture, and for food and feed industries. Several pre- and post-harvest measures can be taken to tackle mycotoxin exposure, but they are not sufficient to eliminate mycotoxins from the food and feed supply chain. In addition, climate change is increasingly affecting the occurrence of mycotoxins worldwide.

Can we ever have a mycotoxin-free supply chain? The tenth conference of The World Mycotoxin Forum aims to contribute to this ultimate goal by taking mycotoxin control to the next level. The conference will offer an excellent way to network, share ideas, and formulate recommendations and conclusions on how to close knowledge gaps.

## Main conference topics:

- What are the future challenges to the stakeholders in the food and feed supply chain?
- What are the main challenges in providing reliable data for supporting the risk assessment of mycotoxins?
- Can holistic approaches to mycotoxin analysis and reduction help take mycotoxin control to the next level?
- What strategies, starting in the field, and continuing to storage, physical removal, processing and detoxification, can help manage the impact of mycotoxins?
- What are the future expectations of integrated solutions to reduce mycotoxins?
- Can incentive mechanisms, computational tools, and state-of-the-

art biotechnological approaches take mycotoxin control to the next level?

## The Forum includes:

- Presentations and discussions in plenary meetings and parallel sessions
- Poster sessions
- Company pitches covering a wide range of topics
- Workshops and demonstrations
- A concurrent instrument/manufacturers' exhibition providing information on equipment, products, and services.
- As a comprehensive overview, the tenth conference of The World Mycotoxin Forum is a vital source of knowledge and information for everyone involved in the food and feed chain. The General Conference Chairs – Prof Dr Rudolf Krska and Hans van Egmond, MSc – and the members of the Advisory Committee are looking forward to meeting you in Amsterdam.

## About The World Mycotoxin Forum

The World Mycotoxin Forum is the leading international meeting series on mycotoxins, where food and feed industry representatives meet with people from universities and governments from around the world. The main objectives of The World Mycotoxin Forum are: to provide a unique platform for the food and feed industry, regulatory authorities and science; to exchange information and experiences on the various aspects of mycotoxins; to review current knowledge related to mycotoxins in food and feed; to discuss strategies for prevention and control of mycotoxin contamination ensuring safety and security of food and feed supply; and to initiate the systems approach for the

control of mycotoxin contamination along conventional and organic supply chains.

## About mycotoxins

Mycotoxins are low-molecular-weight, secondary fungal metabolites that are toxic to animals and humans even at low concentrations. Currently, around 400 mycotoxins are reported. Some of the most common mycotoxins include aflatoxins, trichothecenes, fumonisins, zearalenone, ochratoxin, and ergot alkaloids. The main toxic effects of mycotoxins are carcinogenicity, genotoxicity, nephrotoxicity, hepatotoxicity, oestrogenicity, reproductive and digestive disorders, immunosuppression, and dermal effects.

The occurrence of mycotoxins in almost all types of crops is of great concern as it has significant implications for food and feed safety, food security, and international trade. Mycotoxins cause economic losses at all levels of food and feed production, including crop and animal production, processing and distribution. In general, it is estimated that mycotoxins account for 25% of annual crop losses worldwide. ■



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# FOOD ANALYSIS

Technological advances are bringing regular consumer testing of food for quality and safety closer to reality. Food safety consultant François Bourdichon, and Bert Pöpping, of FOCOS, discuss the implications of consumer testing for the industry.

Every year the European Food Safety Authority (EFSA) publishes data on zoonoses (diseases transmitted from animals) and foodborne disease outbreaks for member states of the EU, and the numbers for 2016 were released recently. Andrew Hudson, of Jorvik Food and Environmental Microbiology, distills a few points of interest.



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A close-up photograph of a person's face, partially obscured by a large magnifying glass. The person is holding a bright red tomato in their left hand, and the magnifying glass is positioned over it. The person's eyes are visible through the lens of the magnifying glass, looking directly at the camera. The background is blurred, showing a yellow object, possibly a pencil or a pen, held in the person's right hand.

# Consumer food testing devices: threat or opportunity?

“From the risk analysis perspective, there is a significant difference between analysing a product for freshness or for a hazard”

Technological advances are bringing regular consumer testing of food for quality and safety closer to reality. Food safety consultant **François Bourdichon**, and **Bert Pöpping**, of FOCOS, discuss the implications of consumer testing for the industry.

**Q**UALITY and food safety testing has until recently been performed under the supervision of trained laboratory technicians within dedicated premises, under the frame of numerous standards such as GLP or ISO 17025 and specifically for Food Microbiology ISO 7218. In order to be more relevant, technology has allowed this activity to be taken outside the laboratory, thanks to portable equipment which allows 'field analysis' to be performed. One widely applied example is truck testing with lateral flow tests for antibiotic residue carried out by drivers when they receive milk from collection points. Portable Fourier transform infra-red (FTIR) devices can also be used on-site by an auditor to test feed and raw material for composition and chemical contaminants.

This feasibility of testing without specific education also resonates with consumers. Although standardisation, certification schemes and food safety surveillance systems have become more efficient, consumer trust in the food industry could be higher. Major safety incidents such as melamine in milk powders can still affect consumer behaviour 10 years after the event. But consumer education and growing awareness of their role within the food chain changes their behaviour. They can do more than join consumer organisations and can now, thanks to technology, play a part in their own safety by testing food themselves – not by sending samples to analytical laboratories, but by using easily accessible testing technologies.

### From field analysis to consumer testing

Over the past few years, a number of food analytical devices that typically work in conjunction with smartphones have been developed specifically with consumers in mind. Funding has

often been raised via crowd-funding platforms like Kickstarter or Indiegogo. Most of these projects were over-funded several times due to a very high interest from investors, small and large alike. Applications range from analysing freshness and nutritional value to identifying chemical contaminants and food allergens.

But from the risk analysis perspective, there is a significant difference between analysing a product for freshness or for a hazard. While freshness is a quality issue, the presence of chemical contaminants such as melamine represents an immediate health risk. Similarly, food allergens present a risk to affected individuals. Such consumer analytical devices have already been developed and are on sale, while many more are under development. Devices marketed in the United States have seen a steady uptake by consumers who want to either avoid components like gluten, for perceived health benefits, or who have an intolerance towards these substances (eg, celiac disease).

Looking at some of those developments, the innovation that has gone into these devices is impressive. Turning a typical laboratory test with many steps and incubation requirements into a single cartridge, liquid-handling-free assay that provides results within a few minutes is not a small achievement.

### Interpretation of results

Such tests in consumer hands bring a bundle of challenges. These include the way the devices are being used (scope of application), as well as interpreting the results.

As an example, what does a negative test result from a restaurant-plate dish mean? Let's assume we are eating a 16oz steak with dark gravy, baked potatoes with sour cream and some vegetables. ➤

### ABOUT THE AUTHOR



**DR BERT** POPPING is Managing Director of the strategic food consulting company FOCOS. He previously worked as Chief Scientific Officer and Director of Scientific Development and Regulatory Affairs for multi-national contract laboratories. Dr Popping has authored over 50 publications on the topics of food authenticity, food analysis, method development and validation as well as regulatory assessments.





“Major safety incidents such as melamine in milk powders can still affect consumer behaviour 10 years after the event”

#### ABOUT THE AUTHOR



**FRANÇOIS BOURDICHON** is a food safety, microbiology and hygiene consultant for the food, dairy, infant nutrition and confectionery industries. He is presently Deputy Chair of the Standing Committee on Microbiological Hygiene (SCMH) of the International Dairy Federation (FIL-IDF).

Testing the brown gravy for gluten returns a negative result. Does this mean the dish is safe for a customer with coeliac disease? Or would he also need to test the sour cream and the starchy sauce that the vegetables came in? It requires the person to understand that sampling a small portion of a mixed dish and obtaining a negative result may not be representative for the entire dish (and therefore would not mean that, based on the single result, the entire dish is safe to eat). On the other hand, testing a food bought from a supermarket shelf and obtaining a positive result does not necessarily mean that a portion is unsafe for an individual with coeliac disease.

Within commercial laboratories, the issue of obtaining invalid results, often referred to as false positives, is known. Causes can include, depending on the type of test, numerous factors such as not-validated or unsuitable matrices. Laboratories can, in most cases, resort to alternative methods (eg, different ELISA kits or PCR assays) to confirm or invalidate the result. That is not typically the case for consumers. A matrix may be unsuitable for a specific test system and result in a false-positive, invalid result. As developers cannot validate all matrices, this is not an unreasonable assumption.

In the past, with certain immunological assays, this phenomenon was observed in laboratories: a test for hazelnut reacted positive in the presence of linseed, for example, or the recent mahaleb adulteration of spices that was mistaken for almond cross-contamination. In those cases, it took laboratories and kit developers several months to figure out the root cause of these issues. Similar

cases of what is known as cross-specificity are well documented. These cases are often discovered through plausibility checking of results.

While food manufacturers, kit developers and most laboratories do have the ability to perform this assessment, most consumers would not. To them, it is a positive result, which means the product, which they considered safe, presents a risk to them. This often results in social media posts and a media storm often follows for the unsuspecting producer. Such events often result in severe brand damage and can lead to unnecessary recalls or a 'delisting' with retailers, banning such products from their stores to maintain customer trust.

#### Setting the rules

In September 2016, a group consisting of food manufacturers, regulators, patient advocacy group representatives, assay providers, laboratories and consumer analytical device manufacturers, was formed. The group's goal was to develop guidelines, primarily for consumer device manufacturers, to help consumers better understand and interpret results, allowing them to safely consume products, as well as mitigating the risk of recalls and brand damage due to false-positive results. The group targeted three main segments:

1. Information provided to consumers
2. Sampling recommendation and information
3. Validation of consumer analytical devices.

As a first step, validation of such devices is key. A non-functioning or error-prone device can endanger consumer health and cause financial loss to food producers. The group postulated that it is insufficient to have such devices validated exclusively by laboratory scientists, who are trained in performing these tasks. Since consumers are the primary target group, it is important to validate the devices using untrained individuals.

Only if the targeted customer group can obtain robust and reliable results should such systems be used. In addition, the group postulated that key matrices (ie, matrices typically tested with such devices by consumers) should be validated. This is key to informing consumers which matrices work and, equally important, which ones may provide false-positive or false-negative results. The group concluded that any such device should undergo independent third-party validation.

The sampling group stated that the instruction manual should contain a section on sampling, stating whether the device is suitable for testing single or multiple foods simultaneously (ie, whether potato mash can be tested together with brown gravy or whether they should be tested separately). There should also be some information on how to avoid cross-contamination. This is a high-risk

issue for generating false-positive results and can happen, for example, when a spoon used to scoop dairy ice cream in a family kitchen is used to test gravy for milk. Another key issue that should be addressed in the sampling section is the previously-mentioned inhomogeneous sample, ie, indicating that testing a single component on a food plate does not represent results for the entire food plate and does not mean the food is safe for the affected individual.


The third group, working on the instruction manual, postulated the requirement of a consumer helpline, as well as explaining the devices' applications and limitations (as discussed above), and the inclusion of information on sampling advice as developed by the sampling group. Guidance on consumer analytical devices, which was developed by the stakeholder group, was recently published in a peer-reviewed article.<sup>1</sup>

### Food for thought

The food industry has made a tremendous effort over the past 25 years, following the 1995 SPS agreement, to enhance its food safety practices by implementing science-based food safety management systems. Consumer trust is the basis of the safety culture within a food company. History has shown that food business operators and retailers cannot do it all. And the food chain has become so complex that administration cannot

be behind every production line or warehouse to ensure that good practices are properly implemented. Consumer education is also key to reducing foodborne diseases.<sup>2,3</sup>

An educated consumer must be active, not reactive. Consumer testing devices therefore present an interesting opportunity to monitor and verify the safety of the food chain. While food business operators are confident in the safety of their product, they may reasonably doubt that all results coming from consumer testing devices are reliable and easy to interpret. It is already a major challenge to ensure the quality of analysis performed by dedicated laboratories, so it should not be underestimated for consumer testing devices.

With additional knowledge comes additional doubts and the need to step back and reflect. The consumer trend for consumers to test food themselves is not something the industry should, or even could, fight against. It will be quite an educational experience for consumers as well as the industry over the coming years. This promises interesting times, with such devices accessible by everyone to test almost everything (or at least, this is the promise made already). Of note, this will show the limitation of a zero-tolerance approach and the need to operate with a reasonable level of risk, as in the 1995 definition of Acceptable Level of Protection. (ALOP). 

**“Consumer trust is the basis of the safety culture within a food company”**

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## Foodborne disease data for the EU

Every year the European Food Safety Authority (EFSA) publishes data on zoonoses (diseases transmitted from animals) and foodborne disease outbreaks for member states of the EU, and the numbers for 2016 were released recently. The document is complex, contains many caveats, is 228 pages long and probably not meant to be read at one sitting, so **Andrew Hudson** of Jorvik Food and Environmental Microbiology has distilled a few points of interest.

IT SHOULD come as no surprise that campylobacteriosis remains the most common zoonotic disease in the EU, with the incidence at 66.3 cases/100,000 (around a quarter of a million cases). The range between member states is astonishing, with an incidence of 228.2 in the Czech Republic and 2.0 in Poland, which suggests that reporting may be less than uniformly applied. Turkeys were more frequently contaminated than broiler chickens, but the opposite was true for their meats. Perhaps broiler chicken processors

have lessons to learn from turkey processors or, possibly, chickens are contaminated with higher concentrations of *Campylobacter* than turkeys. Salmonellosis is next at 20.4, which serves to highlight the numerical dominance of *Campylobacter*.

However, the relative importance of agents could be measured in other ways, for instance by number of fatalities. Using this metric, listeriosis had the greatest impact, causing approximately twice as many deaths as salmonellosis. It is fortunate, then,





that the number of listeriosis cases was low; about 1% of those reported for *Campylobacter*.

The incidence of listeriosis is increasing, however, being 0.47 in 2016 compared to 0.36 in 2012. Food surveys did not identify any 'smoking gun' source (although fish products may warrant further consideration), but these data need to be considered alongside consumption data because an infrequently contaminated food eaten in high volume could still cause a problem.

Less than 40% of human Shiga toxinogenic *Escherichia coli* cases were caused by the O157 serotype, suggesting that excluding the other serotypes from HACCP verification testing may be unwise.

In respect of the outbreak data, salmonellosis was the main culprit, causing 22.3% of outbreaks

of known cause. There was a 23.6% increase in outbreaks caused by *Salmonella enteritidis* – a serovar conventionally associated with eggs and poultry meat but increasingly is being detected in laying hens. Caliciviruses, including Norovirus, caused the highest average number of cases per outbreak. The largest category of outbreak was, however, 'unknown', ie, no causative agent was identified. Another large contributor was bacterial toxins other than botulinum toxin.

*Salmonella* was the pathogen involved in outbreaks causing most hospitalisations and deaths, with *Salmonella* associated with eggs and egg products ranking first in both analyses, which would seem to fit with the increase in *S enteritidis* outbreaks. For 'strong evidence' outbreaks, 39.1% occurred in the home, but caused only 8.1% of the cases, with most cases (24.4%) attributed to outbreaks in canteens, etc. So, while most handling errors occur domestically, the consequences are reduced because the number of people exposed is small compared to that of other settings.

The primary message regarding the current state of zoonoses and foodborne disease outbreaks is that, by and large, it reflects a stable picture. Listeriosis, while still rare, is increasing in the elderly (and this is not a reflection of increased life expectancy) with no obvious food type manifestly requiring attention. There are many theories as to why this increase is happening, but control of *Listeria* in food needs to be enhanced to contain it. *Salmonella enteritidis* cases and outbreaks have increased and this seems to be linked to increasing flock prevalence in layer hens and hence is amenable to targeted control measures. If the trend has continued since 2016, manufacturers using eggs as an ingredient need to be aware! 📌

**The full report can be read here:**

[www.efsa.europa.eu/en/efsajournal/pub/5077](http://www.efsa.europa.eu/en/efsajournal/pub/5077)

“*Salmonella* was the pathogen involved in outbreaks causing most hospitalisations and deaths”

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**ANDREW HUDSON** is a Fellow of the Institute of Food Science and Technology. He has a BSc (Hons) from Bristol University and a doctorate from New Zealand's University of Waikato. Mr Hudson has published more than 90 peer-reviewed papers, reviews and book chapters. He currently works at Jorvik Food and Environmental Microbiology.

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# What are GMOs?

## Enlightening the limping legal language



New breeding techniques (NBTs) for genetically modified organisms (GMOs) have further complicated the legal definitions around GMOs for food use. **Bernd van der Meulen** of Wageningen University and **Gema Fernández Albújar** of CEFS discuss the issues.

**F**OR better or for worse, GMOs have been regulated to death in the EU. If a crop or food is classified as a GMO it has to be submitted to an authorisation procedure that only the most powerful businesses can afford to pursue. Even for these, the outcome of the procedure is uncertain as it seems to depend less on scientific evidence of safety than on political considerations. Even if the product is authorised,

it will meet with limited or no public acceptance. In the EU, therefore, to be or not to be a GMO is indeed a matter of to be or not to be.

The question of the scope of the concept of GMO in EU law has acquired fresh urgency with the advent of new breeding techniques (NBTs). If genetic engineering exclusively uses genetic materials from the same genepool, the results could also have been achieved using conventional

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**PROFESSOR DR BMJ VAN DER MEULEN** is a food legal consultant, Professor of Food Law at Wageningen University, Member of the Board of Global Harmonization Initiative, GHI, [www.globalharmonization.net](http://www.globalharmonization.net) (which is setting up a working group on GMOs), and Director of the European Institute for Food Law. Readers who are interested in participating in the GMO working group are invited to contact GHI.



breeding techniques – although this might have taken decades. Increasingly, methods are becoming available that achieve results which could also be achieved with conventional breeding, but much faster. Such products that are in this sense 'nature-identical' but are achieved using tools from modern gene technology, are fundamentally different from products achieved by inserting foreign genes into plant species as in what we know as biotechnology. But are these results from NBTs also GMOs?

A European lawyer's approach to this question is to confront the products from NBTs with the EU legal definition of GMO in the GMO directive. Unfortunately, this confrontation does not yield an unambiguous answer. In EU law, a GMO is an organism "in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination". Taken at face value, this wording could mean two different things. It could refer to the product if the alteration could have been achieved naturally and the product is not altered in a way that does not occur naturally. Alternatively, it could refer to the process if the alteration was achieved through mating and/or natural recombination. Both readings are equally plausible. Thus, the text of the directive alone is not enough to provide definite answers.

The classification as GMO or not is not a matter of safety as such, but only of the framework under which the safety, market access and consumer information are assessed. If it is not the GMO framework, the applicable framework in the EU could be the General Food Law or the Novel Foods Regulation.

In such situations of legal uncertainty, the final interpretation of the law has to be provided by the courts. In the case of EU law, the competent court is the Court of Justice of the EU in Luxembourg.

### Legal interpretations

With regard to one of the new breeding techniques – directed mutagenesis – a question for clarification has been raised by the highest administrative law court in France: the Conseil d'État.

Unfortunately, the question focusses specifically on the applicability and validity of an exception for mutagenesis.<sup>1</sup> If the Court only answers the question regarding the exception without addressing the definition of GMO itself, the answer will not contribute to a better understanding of the GMO concept. In the French legislation implementing the GMO directive, the ambiguity of the official definition has been glossed over and replaced by a definition focussing exclusively on the process. Thus, in phrasing its question the Conseil d'État may not even have been aware of the issue that needs to be clarified.



It is not just the English language where the definition can be read in two different ways. As far as we know, only in the Bulgarian, Czech and Polish language versions of the directive is a wording chosen favouring the procedure. Interestingly, all three countries joined the EU after the definition was formulated. In the Dutch, German, Greek, Italian, Portuguese, Spanish, Swedish, and even French language versions, we find the same ambiguity as in the English.

On 18 January, the Advocate General (AG) issued his opinion on the case. The AG is an independent advisor of the Court.<sup>2</sup> While he does underscore that, before turning to the exception, first one has to check whether the definition is fulfilled, he gives no indication of realising that there is a problem with this definition that needs to be resolved.

It is to be hoped that the EU Court will address the scope of the GMO concept in full before turning to exceptions. Obviously, in the political minefield it will be tempting for the Court to take the easy way out and leave the issue unresolved. However, if the Court musters the courage to provide a clear interpretation many people will not hear what they would like to hear, but at least there will be legal certainty for the sector. For better or for worse. (Some of) the NBTs may be free from the GMO burden, or they may be dead in the EU (just) as GMOs.

### Acknowledgement

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### ABOUT THE AUTHOR



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holds two bachelor degrees in Law and Political Sciences and Masters in EU Law and in Legal Practice. She has more than seven years' professional experience with legal issues in law firms, EU organisations and academia. Her areas of expertise include EU law, food law and food safety. At present she conducts food legal research at the European Institute for Food Law (EFLA), where she is a member.

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# Clean air – the vital ingredient to food and beverage manufacturing



14 MARCH 2018



15:00 BST

Air is the only ingredient that is involved in every aspect of food and beverage manufacturing. In this webinar, sponsored by Camfil, Ross Dumigan and Patrik Jansson of Camfil, and Kassy Marsh of Techni-K Consulting, discuss the importance of clean air in food manufacture and the associated regulations.



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Ross Dumigan has worked with Camfil for over 15 years. This experience allows him to understand the clean air requirements in food and beverage facilities. Mr Dumigan engages and lobbies with standards committees to ensure air quality standards are improved globally.

Patrik Jansson specialises in identifying and reducing internal contaminants within food and beverage manufacturing plants. Working with world-leading producers has allowed Mr Jansson to gain valuable knowledge of air quality requirements within these facilities.

Since starting her own training and consultancy business, Techni-K, in 2012,

Kassy Marsh has become well regarded in the field of food safety risk assessment and specialises in the Global Food Safety Initiative (GFSI) recognised standards. Ms Marsh is the author of 'Combine your HACCP & HARPC Plan, step-by-step' and co-author of 'Assessing Threat Vulnerability for Food Defence' and, 'Assessing Error Vulnerability for Food Integrity'. 

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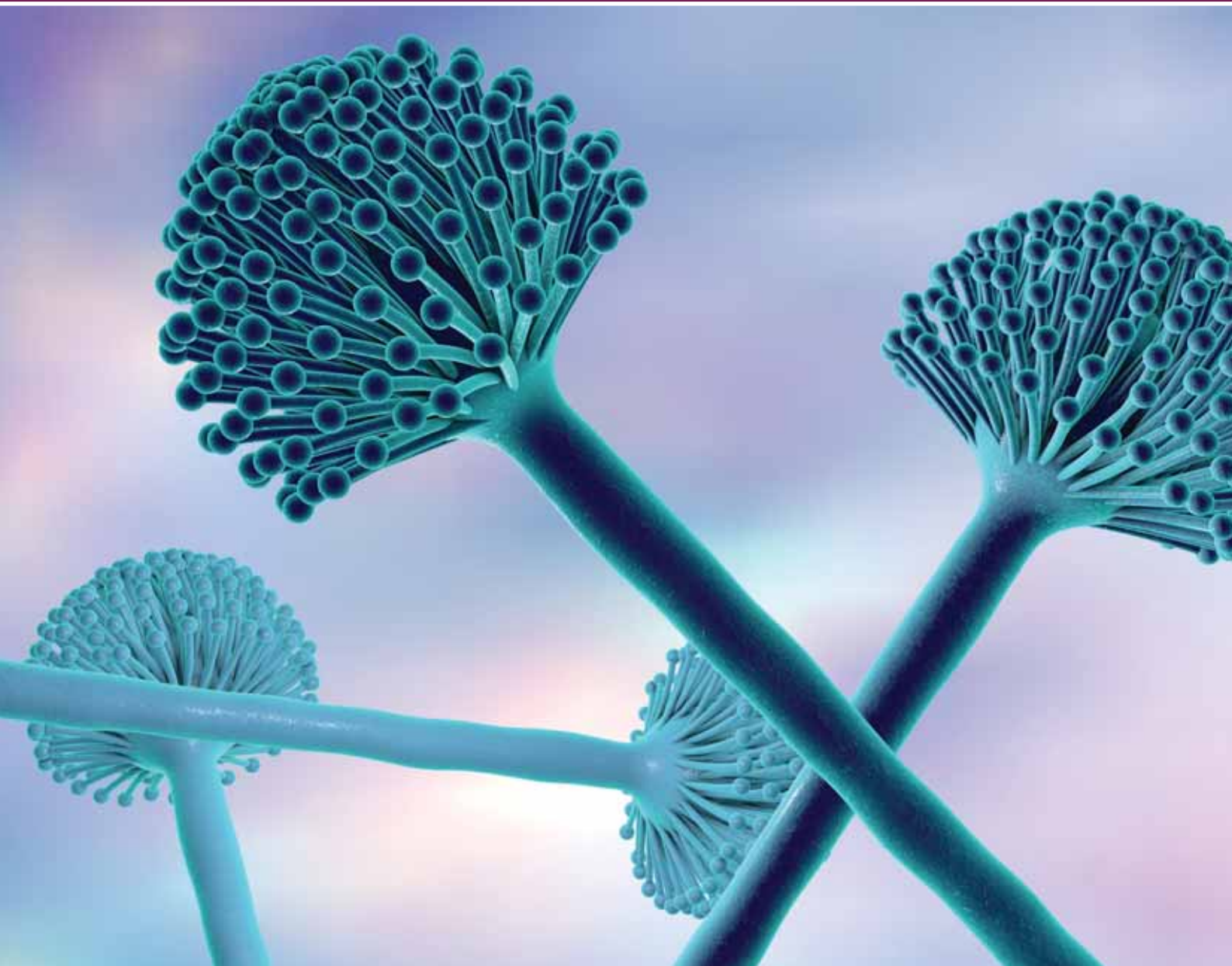


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# MYCOTOXINS

Much remains unknown about mycotoxins. A much better understanding is needed of their effects and how to mitigate against their impact on human wellbeing, farm animal wellbeing and reducing food waste to bolster food security, says Chris Elliott, of Queen's University Belfast.

Mycotoxins contaminate over 25% of the global food supply, leading to annual losses of around 1.0 billion tons of food and food products. Ahmad Alshannaq and Jae-Hyuk Yu, of the University of Wisconsin-Madison, consider which foods are most susceptible to contamination and the best analytical methods.







# Mycotoxins:

## time for a global rethink?

Much remains unknown about mycotoxins. A much better understanding is needed of their effects and how to mitigate against their impact on human wellbeing, farm animal wellbeing and reducing food waste, to bolster food security, says **Chris Elliott** of Queen's University Belfast.

“Huge datasets tell us that we suffer co-exposure to many mycotoxins from our food supply system”

**A**DVANCES in analytical science have brought about a much deeper knowledge of the broad spectrum of mycotoxins that fungi can produce. Thus, human exposure studies can be conducted to undertake risk assessments which, in turn, guide regulations. I fully understand the rationale for how regulators work and what a difficult job they have in balancing food safety and food security, but still I think the processes are somewhat flawed.

To me this is like undertaking risk assessments for boxing, but making separate assessments for

blows to the head, the ribs, the kidneys and so on. The point I am trying to make is that the risk is to the boxer, not to their individual components. So why should mycotoxins be different?

Huge datasets tell us that we suffer co-exposure to many mycotoxins from our food supply system and that some of these have additive and synergistic effects. I once discussed this with very good scientists based at the European Food Safety Authority (EFSA) in Parma. The response I got was quite surprising and it went something like: “Of course you are right, but it is far too difficult for regulators to get their heads around.” Of course,



trade? If it is more the latter, do not expect any changes in how we determine the presence of potentially harmful chemicals in our foods for a long time.

### Multiple mycotoxins in animal feed

I wanted to turn the attention of my article to a completely different topic around mycotoxins but I find the subject of regulations cuts across this as well. This time it is about the monitoring and effects of multiple mycotoxins in animal feed materials. A combination of better analytical measurement tools and the impacts of climate change have shown that most farm animals are exposed to mycotoxins on a regular basis through their feed supplies. This is particularly true for those species farmed intensively and the fact that they are generally monogastrics (have one stomach). So poultry and pigs are, by quite some distance, the most important species in terms of suffering from the adverse effects of exposure. However, I am also sure that the extent of the impact mycotoxins present in the diet of ruminant animals (more than one stomach) is also underestimated.

For animal feed materials brought into and traded in Europe a mixture of regulations and guidelines must be followed concerning mycotoxin levels, at least currently for a relatively small number. The first difficulty this causes is how to measure mycotoxin levels in feed materials. The fungal contamination and growth that can

**“ Most farm animals are exposed to mycotoxins on a regular basis through their feed supplies ”**



**LEFT:** Black mould fungi *Aspergillus*, which produce aflatoxins

to move from the very nice, tidy, quantitative mass spectrometric analysis for individual mycotoxins to something much messier such as measuring the biological effects of mycotoxin mixtures is far from straightforward. But did we not achieve something this way for mixtures of PCBs and dioxins and mixtures of paralytic shellfish poisons, ie, by applying toxicity equivalence factors?

To do this for mycotoxins is a much bigger step, or indeed series of steps, but something at least worth considering. I guess this question also hangs around the purpose of regularity limits for mycotoxins in foods. Are they to protect the consumer or more around facilitating international



**LEFT:** Poultry and pigs are the most important species in terms of suffering adverse effects from mycotoxin exposure





**ABOVE:** Climate change could worsen the problem of mycotoxin contamination



## ABOUT THE AUTHOR



**CHRIS ELLIOTT** is Professor of Food Safety and Director of the Institute for Global Food Security, Queen's University Belfast. He has published more than 350 peer-reviewed articles, many of them relating to the detection and control of agricultural-, food- and environmental-related contaminants. Prof Elliott's main research interests are in the development of innovative techniques to provide early warning of toxin threats across complex food supply systems.

create mycotoxins can happen before harvest or during storage, so deciding when to do the analysis can be tricky. Where and how to take many samples is also problematic. 'Mycotoxin hot spots' often lie within the inner reaches of grain consignments due to damp, warm areas where fungi can thrive. So despite the best efforts of many it is likely that mycotoxin exposure in farm animals is greater than the data suggests.

While it is very clear in EU regulations that if regulatory mycotoxin limits are exceeded the grains cannot enter the food system, what should be done if mycotoxins are found below regulatory limits but at levels known to adversely affect the wellbeing and performance of farm animals? There are a limited number of options. The first is to divert the grains from monogastrics to ruminants and to my mind this is just about lessening the mycotoxin impact but not removing it. The second option is to add a mycotoxin binder or deactivator to the grains to render them biologically inactive.

Quite a number of binders/deactivators are on the market, some of which claim to bind to multiple mycotoxins. I am less sure about some of these claims and wonder whether they also bind some of the micronutrients. There is also the cost of these products to consider. With farm incomes in so many parts of the world challenged, feed mills and indeed farmers will, in many cases, think twice about this form of mycotoxin intervention. So perhaps the main thrust of future research should be to try and prevent the contamination of grains with fungi, pre- and post-harvest.

### Preventing fungal contamination


So, mycotoxins are a difficult subject area and still lots remains to be found out about how to cope with a serious problem and one that can only get worse with climate change. In terms of human

exposure it is clear that the developed world is much better protected than the developing world.

I reviewed some data generated by one of my PhD students recently. He undertook a survey of the mycotoxins present in different grains available in the markets of the capital city of Somalia, Mogadishu. The data was quite shocking, with levels of aflatoxins and fumonisins present many hundreds of times greater than we accept as being safe in Europe. Of course a look at the scientific literature will show other cases where mycotoxin exposure in developing countries is of the same order of magnitude. The impact on these societies is huge. Substantial evidence links mycotoxin exposure to child stunting. The World Health Organization (WHO) calls growth stunting one of the most significant impediments to human development. Then there are the cancers linked to mycotoxins. For example, while cases of liver cancer in the developed world are declining, the opposite is true in parts of the developing world, and mycotoxin exposure must be playing some role in this.

With such huge social, health and economic impacts, what can or should be done? In terms of investment in a region, surely the starting points must be to have a safe and secure food and water supply. The World Bank recently surveyed hundreds of multinational companies to find out what drives decisions around foreign direct investment. The results show that investors value a business-friendly regulatory environment as well as stable macroeconomic and political conditions. To me, having safe food and water fits at least some of these criteria rather well.

It is an interesting parallel that China, a country prone to serious food safety issues, is ensuring that when multinational food businesses invest in China part of that investment must help improve food safety. Perhaps this is too radical a thought, but what about taking a Sub-Saharan country as a pilot and use part of the inward investment to deliver a system to control mycotoxin exposure? Many of the required interventions are well known and often involve good education and relatively low-cost solutions.

Then what about those scientific and technological interventions that we fear to mention in case Greenpeace gets to hear of them? For example, the use of low-energy electron beams (better known as irradiation) or crops resistant to fungal disease (such as GM crops). Can we really discount these because some vocal lobby groups tell us they are unsafe despite the large amount of scientific data telling us otherwise? Personally, I would relish opportunities to openly discuss the unthinkable in terms of helping control the dreadful impacts that mycotoxins have on the wellbeing of so many. 



# Maximising mass spectrometry capabilities in food analyses for multiresidues



27 MARCH 2018



15:00 BST

Routine testing laboratories continue to strive for efficient and reliable sample throughput. Multiresidue pesticides is an example of this, where the generic extraction offered by QuEChERS has streamlined sample preparation. However, for comprehensive pesticide testing, both liquid and gas chromatography are typically required.



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Dr Organtini received her PhD from Penn State studying the occurrence of dioxins and

furans in fire debris. Since 2015 she has been a Senior Scientist at Waters focusing on food and environmental sample analysis.

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# Mycotoxin contamination and food safety concerns

**Vanessa Cowan** and **Barry Blakley**, from the University of Saskatchewan, discuss the safety risks associated with mycotoxin contamination of food and animal feeds.

**M**YCOTOXINS are toxic metabolites produced by a wide variety of fungal species and mycotoxin contamination is a worldwide problem. Many mycotoxins are extremely potent chemicals and produce a variety of diseases in both humans and animals. Contamination of feeds with minute quantities can cause severe clinical disease.

Diseases associated with mycotoxin contamination of feeds have been recognised for centuries. During the Middle Ages, many people consuming rye bread contaminated with ergot mycotoxins during periods of famine developed a disease known as St Anthony's Fire. Reduced blood flow and gangrene often caused a burning sensation in the limbs. In other individuals, the

ergot alkaloids produced hallucinations and abnormal behaviour. During the Salem Witch Trials, those persecuted as witches are now thought to have been experiencing ergot poisoning. Several of the ergot alkaloids chemically resemble the hallucinogen lysergic acid – an association that provides a plausible explanation for this 'witch-like' behaviour.

In more recent times, unexplained disease outbreaks in both humans and animals have been recorded in many countries. This is more common when extensive fungal contamination of feed has occurred, or during prolonged periods of famine. *Fusarium* spp. moulds have often been associated with disease outbreaks. T-2 toxin, vomitoxin, and related *Fusarium* mycotoxins have been identified

## ABOUT THE AUTHOR



**DR BARRY BLAKLEY** is a veterinary toxicologist at the University of Saskatchewan in Canada. He obtained his BSc, DVM and MSc at the University of Saskatchewan and his PhD at the University of Cincinnati, USA. Currently, he supervises the diagnostic toxicology laboratory for Prairie Diagnostic Services. Dr Blakley has generated more than 100 manuscripts and book chapters related to immunotoxicology, veterinary toxicology and nutritional toxicology.





LEFT: Ergot fungus, *Claviceps purpurea*

as causative agents. In many countries today, clinical mycotoxin poisoning has virtually been eliminated. Strict regulatory guidelines, the ability to detect extremely low concentrations of these agents in feed, and a better understanding of the toxic mechanisms account for the dramatic reduction in clinical disease.

### Why mycotoxin contamination persists

Modern science has identified many fungi that can produce mycotoxins. Some of the more frequently encountered fungi genera include: *Claviceps*, *Penicillium*, *Fusarium*, and *Aspergillus*. For each genus, many species may be involved. Consequently, the number of potential mycotoxins with health implications numbers in the hundreds. To test for all possible mycotoxins, particularly at low concentrations, is difficult and requires highly sophisticated instrumentation.

The growth of mycotoxigenic fungi and mycotoxin contamination is highly variable from country to country. Many factors influence mould growth and, consequently, mycotoxin production. Some factors include:

- Mono culture crop production
- Poor crop rotation management
- Ambient temperatures
- Fungicide use
- Rainfall or humidity
- Insect infestation
- Storage conditions
- Agricultural practices
- Harvest techniques.

For each type of mould, the impact of these factors may vary considerably. The biology of plant development and plant species susceptibility are

important factors. It is important to note, however, that the presence of mould does not necessarily indicate the presence or absence of mycotoxins.

### Mycotoxin-related disease problems

With the number of potential mycotoxins present in the environment, many clinical syndromes are possible. Unfortunately, substantial human disease has been documented. Many countries have well-defined safety limits based on previous disease outbreaks and subsequent chemical analysis. In many instances, mycotoxins produce specific toxicological damage and a 'predictable' clinical disease. Discussion will be limited to a select few mycotoxins with worldwide significance, although this may vary from region to region.

The mycotoxin, aflatoxin, produced by the *Aspergillus* fungus, is noteworthy. It is often identified in corn or peanuts. Chronic exposure to aflatoxin will result in liver damage, decreased immune system function, and potentially cancer. Aflatoxin is one of the few mycotoxins associated with cancer. Consequently, the standards in both human and animal feeds are extremely low. Some forms of aflatoxin are excreted into milk, resulting in major food safety concerns for children.

Vomitoxin, or deoxynivalenol, is another mycotoxin seen worldwide. This agent, plus mycotoxins such as T-2 toxin and diacetoxyscirpenol, are produced by various *Fusarium* fungi. These mycotoxins are extremely toxic to cells, especially affecting rapidly dividing cells. Consequently, the immune system and the foetus are primary targets for poisoning. It should be noted that many feeds may contain clinically relevant mixtures of these mycotoxins. These mycotoxins have the potential to produce additive toxic effects.▶

“Some forms of aflatoxin are excreted into milk, resulting in major food safety concerns for children”



BELOW: Hereford cows that were part of a low-level study by the University of Saskatchewan to assess reproduction and tolerance to ergot



**RIGHT:** Angus bulls that are part of an ongoing study by the University of Saskatchewan to assess the effects of ergot on spermatogenesis



**“Analytical techniques, chromatographic and colorimetric assays, have enabled researchers, diagnostic labs, and regulatory agencies to detect most mycotoxins in a routine fashion”**

#### ABOUT THE AUTHOR



**VANESSA COWAN** is a PhD student at the University of Saskatchewan. She is studying the effects of ergot alkaloid mycotoxins on cattle physiology, including the cardiovascular, endocrine, and reproductive systems. Vanessa graduated from the Toxicology Undergraduate Programme at the University of Saskatchewan in 2014 and started graduate studies that same year. She is supervised by Dr Barry Blakley and Dr Jaswant Singh.

Another mycotoxin produced by the *Fusarium* fungi is zearalenone. In many countries, this mycotoxin is associated with corn, which is a common feed source worldwide. Zearalenone mimics oestrogen pharmacologically. Consequently, it is an endocrine system disrupting chemical, resulting in infertility and varied reproductive problems.

Ergot alkaloids produced by the *Claviceps* fungi are another past and present mycotoxin problem. This group of mycotoxins has been associated historically with cereal grains such as rye, but the fungus can affect most grass or cereal species. In wet, monoculture agricultural regions, the problem is extensive. There is substantial species variation, although gangrene and reduced milk production are frequently observed. In western Canada, ergotism historically was a rare event. However, with changes in agricultural practices and climate, the occurrence of ergot contaminated feeds has become commonplace. Some have suggested global warming as an important factor. With substantial contamination of animal and human feeds, routine testing by agriculture companies has now become the new industry standard.

#### Mycotoxin testing

For many years, the detection of many varied mycotoxins at low concentrations has been a challenge. Recently, analytical techniques, chromatographic and colorimetric assays, have enabled researchers, diagnostic labs, and regulatory agencies to detect most mycotoxins

in a routine fashion. Consequently, analytical services in most countries are limited to a few specialised facilities.

Many laboratories analyse feed samples exclusively. In feed samples, the concentrations are often higher and methods are well-established. Analysis of blood or tissue samples is possible, but the concentrations of the mycotoxins and numerous metabolites are extremely low. This is often a consequence of the rapid elimination of many mycotoxins from the body. As such, detection of mycotoxins in blood or other tissues is difficult in many laboratories since most mycotoxins are often present in mixtures with variation from plant to plant and region to region. Consequently, many labs provide panels or multiple analyses on a small sample as a routine service. Mycotoxin interactions and varied potency of individual components often make clinical or regulatory interpretation a problem.

#### Food safety


The major concern among the public worldwide is the safety of mycotoxin-contaminated feeds or the consumption of meat or milk from animals consuming contaminated feeds. Most countries have regulatory agencies that establish tolerance limits for animal and human feeds. Establishing standards for each mycotoxin is complex, as there is considerable variation from country to country. The import and export of many grains is influenced by current international standards. The assessment of risk due to mycotoxins in food includes many factors, such as:





- Amount of food consumed
- Age (young/old)
- Pregnancy/lactation
- Mycotoxin interactions
- Mycotoxin absorption, metabolism
- Nature of the disease (eg, cancer).

As new data becomes available, standards are reviewed and revised. With changing conditions worldwide, this is an ongoing challenge. Since many of the mycotoxins are extremely potent, many standards for chronic exposure are extremely low. Most mycotoxins are not persistent chemicals and in food-producing animals, like cattle, swine, or poultry, the mycotoxins are rapidly metabolised and detoxified. Excretion into milk is possible in some instances, but is rarely a significant concern. Consequently, animal food residues for human consumption are not a major concern. The regulatory agencies tend to focus food safety concerns on feeds derived directly from grain or cereal crops. Other sources of mycotoxin exposure, such as water or air, are not considered significant from an agricultural perspective, although moulds growing in ventilating systems affect air quality in urban areas.

As mycotoxin contamination becomes more commonplace, the diagnosis, treatment, and prevention of clinical disease, and associated analytical testing and regulatory standards, will evolve. This worldwide problem will need continual monitoring and review. 

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## Mycotoxins: invisible and insidious foodborne toxicants

Mycotoxins are small molecular weight fungal toxins that contaminate over 25% of the global food supply, leading to annual losses of around 1.0 billion tons of food and food products. **Ahmad Alshannaq** and **Jae-Hyuk Yu**, of the University of Wisconsin-Madison, consider which foods are most susceptible to contamination and the best analytical methods.

**F**OODS are life's artery, providing essential nutrients and energy to people and animals. A major challenge facing the world is keeping the food supply safe and sustainable. Food safety is a complex issue that involves all segments of society: public, government, industry, and academia. Mycotoxins are an often underappreciated threat to food safety.

Mycotoxins are toxic secondary metabolites produced by filamentous fungi (moulds) belonging to three main genera: *Aspergillus*, *Fusarium* and *Penicillium*. These fungi can grow on crops and some fruit and vegetables in fields, and can infest food and feed during processing, distribution, and storage. When moulds grow in foods, they often produce mycotoxins. While over 300 mycotoxins have been identified, seven frequently contaminate food and feed, and are subject to regular monitoring and regulations for about 120 countries. These are

aflatoxins (AFs), ochratoxin A (OTA), fumonisin B1 (FB1), deoxynivalenol (DON), trichothecene (T-2), zearalenone (ZEN), and patulin.

Poor harvesting, improper processing, and bad storage conditions facilitate fungal growth and mycotoxin contamination. Mycotoxin contaminations occur in a wide range of food commodities around the world, especially in those countries with high temperature and humidity climates. However, with global climate change, mycotoxin-producing moulds can grow on more crops and will become a major food safety issue even in those regions with historically few mycotoxin contamination problems, such as Europe.

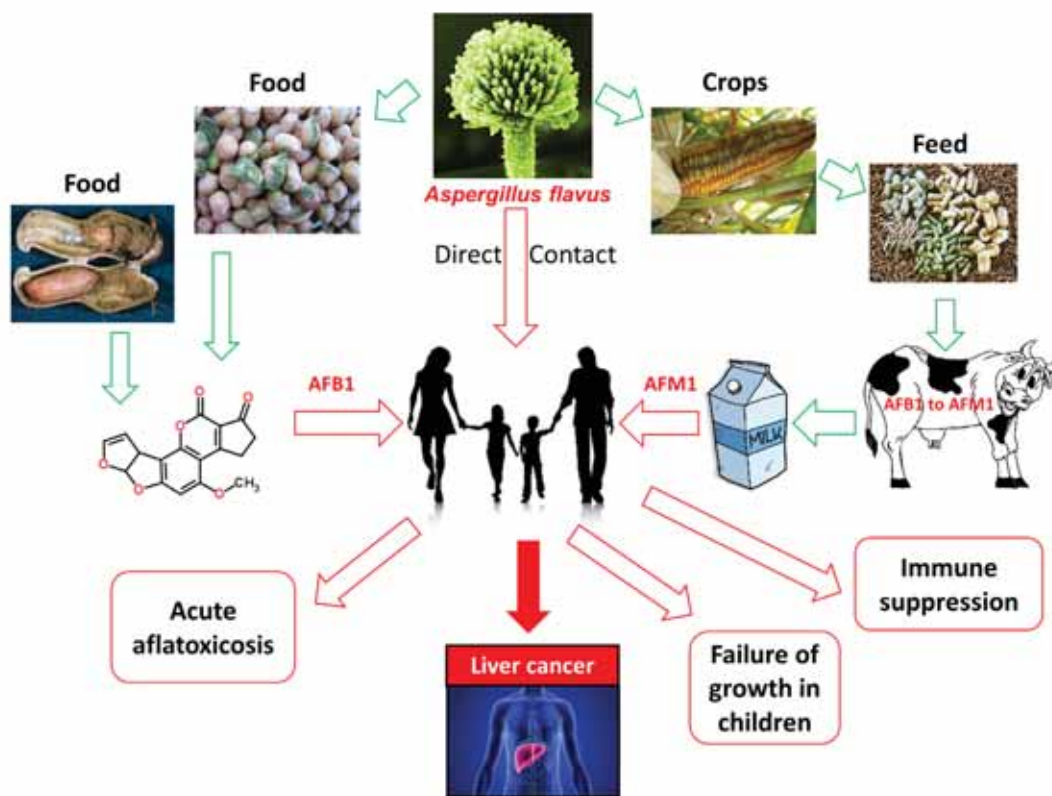
### Occurrence and route of exposure

Human exposure to mycotoxins occurs mainly through the consumption of contaminated ►

**RIGHT:** Aflatoxin B1 (AFB1) and M1 (AFM1) contamination routes and adverse health effects



**FIGURE 1**



## ABOUT THE AUTHOR



**AHMAD ALSHANNAQ, DVM, MS**, is a Foster Fellow of the Food Research Institute and a PhD candidate in Food Science under the supervision of Dr Jae-Hyuk Yu at the University of Wisconsin-Madison. His research focuses on the development of novel, natural, and safe methods for the detoxification of aflatoxins and other key mycotoxins in food and feed. He has a bachelor's degree in veterinary medicine and surgery (DVM), and a master's degree in pharmacology and toxicology.

plant-based foods. However, when animals consume feed contaminated with mycotoxins, residue and/or metabolite(s) of the mycotoxin(s) can persist in milk, meat, or eggs. Infants who are breastfed can be exposed to the toxins via nursing mothers who consume food contaminated with mycotoxins. However, most mycotoxin risks to humans are due to chronic dietary exposure. Infrequently, acute fatal outbreaks have occurred in Africa, and farmers and other agricultural workers can become sick by exposure to fungal spores and particles during the handling and processing of mycotoxin-contaminated crops.

Mycotoxins can contaminate a wide variety of food commodities and feeds. Concurrent contamination of food with multiple toxins poses additional challenges for food safety. Aflatoxins can contaminate almost all crops, including maize, rice, wheat, barley, oats, sorghum, peanuts, ground nuts, pistachio nuts, almonds, walnuts and cottonseeds, and even spices and herbs (**Figure 1**). Ochratoxins, especially OTA, often contaminate coffee, wine, grape juice, dried vine fruits, and less frequently corn, wheat, barley, flour and rice. Fumonisin, notably FB1, commonly contaminate maize kernels as well as sorghum, wheat, barley, soybean, asparagus spears, figs, black tea, and medicinal plants. Deoxynivalenol, T-2, and zearalenone mainly contaminate cereals such as

wheat, barley, oats, rye, maize, and rice. Patulin predominantly contaminates apples, apple juice, and apple products. However, other fruit including pears, peach, and grapes, are also vulnerable to patulin contamination.

## Health and economic impacts

Mycotoxin ingestion can have various chronic and acute effects on humans and animals, as they can be hepatotoxic, genotoxic, immunosuppressive, oestrogenic, nephrotoxic, teratogenic, and/or carcinogenic. However, the most significant global concern is the carcinogenic effect of mycotoxins.

The World Health Organization (WHO) has identified aflatoxins as major foodborne chemical toxins. Among all mycotoxins, aflatoxins – especially AFB1 – are considered to be the most toxic, teratogenic, and carcinogenic, and are classified as Group 1 carcinogens to humans by WHO-IARC (International Agency for Research on Cancer). AFB1 is the most hepato-carcinogenic mycotoxin and has been demonstrated to be the main contributor to liver cancers worldwide (**Figure 1**). A trace level (as low as 20 parts per billion) of AFB1 can be dangerous; foods with higher levels are not fit for human consumption. Alarming, the United States Center for Disease Control estimates that over 4.5 billion people in the world are exposed to unmonitored levels



of AFs, leading to about 155,000 liver cancer cases annually.

In the US, EU, and other developed countries, AFs are primarily an economic concern. For example, the US corn industry loses about \$52.1m to \$1.68bn annually due to AF contamination, and the US and Canada together lose about \$5bn each year due to contamination of food and feed with various mycotoxins. Mycotoxins are the main hazard cited in EU border rejection notifications, according to the Rapid Alert System for Food and Feed (RASFF, 2016), with AFs taking the lion's share (~70%) of such notifications. In other regions such as China, Southeast Asia and sub-Saharan Africa, AFs not only contribute to thousands of hepatocellular carcinoma cases each year, but also cause huge food and economic losses due to failures to meet export standard limits for AFs. In sub-Saharan Africa alone, about 26,000 deaths and \$700m in economic losses are attributed to AF contamination.

### Methods for mycotoxin reduction and analysis

Despite the scrutiny that public health and prevention managers in many areas of the world have paid to mycotoxins, they remain a major global food safety issue. While strategies such as adopting good agricultural practices, growing resistant crop varieties, rotating crops, soil tillage, chemical and biological management of plant diseases, insect control, and proper harvest and storage conditions are good tools to prevent fungal growth and mycotoxin contamination in agricultural commodities, they fail to guarantee the absence of mycotoxins in food and feed.

Conventional food processing such as cooking, boiling and roasting has very little effect on mycotoxins, especially AFs; therefore, the toxins should be removed or destroyed before they reach consumers. Numerous strategies employing physical, chemical, and/or biological methods have been developed to remove the toxins in raw material. One new, not yet clinically tested, approach involves the use of specific binders to inhibit the absorption of mycotoxins in the gastrointestinal tract of humans and animals. However, there are currently no effective and safe methods that completely remove mycotoxins, especially AFs, from food and feed.

Although tremendous progress has been made in the quantitative and qualitative analyses of mycotoxins, the major challenges and drawbacks of current analytical methods still need to be addressed. Analytical challenges include low-level mycotoxin contamination, complex food matrices necessitating complicated extraction processes, the great chemical diversity of mycotoxins, and the co-occurrence of mycotoxins.

A key step in the analysis of mycotoxins in food is the sampling procedure, which greatly

contributes to the reliability of the results and the final assessment of compliance or non-compliance for an entire food batch. Due to the uneven distribution of mycotoxins in food, it is extremely challenging to obtain representative samples from bulk products. Thus, a carefully considered sampling plan must be implemented to ensure that the tested samples adequately represent the whole bulk.

Many mycotoxin analytical methods have been described; however, chromatography methods coupled with mass spectrometry detection and a suitable extraction technique are the methods of choice for analysis of single and multiple mycotoxins in the lab. In the field, a number of on-site strip methods with simple portable devices (or even without any instrument or readers) have been developed for rapid qualitative analysis of single mycotoxins. Many kinds of rapid visual strips for on-site testing of mycotoxins are commercially available, including lateral-flow, dipstick, and flow-through devices.


Other research methods, such as infrared spectroscopy, capillary electrophoresis, molecular imprinting polymers, fluorescence polarisation, biosensors, and electronic nose have potential utility for the analysis of mycotoxins. However, these methods have limited applications and have not yet been widely used outside the research environment as they require further verification and validation.

### Summary

Mycotoxins are unpredictable and unavoidable contaminants that can be present in a wide variety of food and feed. They have been an open challenge for food safety, pose a serious risk for human and animal health, and lead to massive economic losses to the agriculture industry. Aflatoxins are the most problematic mycotoxins, claiming many lives each year in developing countries and causing huge food and monetary losses worldwide. The main challenges in the analysis of mycotoxins in food are proper sampling and extraction, rather than the analytical methods themselves. Collaborative and continuous efforts by farmers, governmental authorities, academia, and industry are needed to tackle mycotoxin problems.

For more comprehensive information about mycotoxins, please read our review article: Alshannaq A, Yu J-H. Occurrence, toxicity, and analysis of major mycotoxins in food. *Int J Environ Res Public Health*. 2017, June;14(6):632. [www.mdpi.com/1660-4601/14/6/632](http://www.mdpi.com/1660-4601/14/6/632)

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**“ While over 300 mycotoxins have been identified, seven frequently contaminate food and feed ”**

### ABOUT THE AUTHOR



**JAE-HYUK YU**, MS, PhD, is Professor of Bacteriology and Genetics and a core executive member of the Food Research Institute at UW-Madison. He is also a Faculty of 1000 Member for Microbiology and an editorial board member of *Scientific Reports*. After completing postdoctoral training at Texas A&M University, Jae-Hyuk worked as a Senior Scientist (Team Leader) at Cereon Genomics (a subsidiary of Monsanto Company) until he joined UW-Madison as a faculty member in July 2000.

# A guide to food plant air quality and control

A high standard of air quality is vitally important in the food processing environment, making control of airborne microorganisms, fungi and other bioaerosol contaminants a critical action item on all food manufacturers' to-do lists. But how do you effectively institute preventive controls when the vehicle for potential contaminants is literally everywhere; on every surface and in every nook and cranny, from receiving dock to loading dock? **Thomas Caesar** of EHEDG explains.

**I**N ONE of its latest guidelines, the European Hygienic Engineering and Design Group (EHEDG) identifies hygienic air quality control as a top priority to promote good manufacturing practice that ensures the safe production of food. Published in September 2016, EHEDG Doc 47, 'Guidelines on Air Handling Systems in the Food Industry – Air Quality Control for Building Ventilation', is a 56-page, fully referenced guideline produced by the EHEDG working group on 'Air Handling', which I chair. In addition to a number of informational images and illustrations to help users troubleshoot and ensure air handling

unit (AHU) efficiencies, the guidelines also include a useful checklist for the operation and maintenance of air handling systems in food processing facilities.

EHEDG Doc 47 offers food producers a thorough insight into the dos and don'ts of designing, selecting, installing and operating air handling systems to achieve high standards of building ventilation quality and hygiene. In this first edition, the guidelines focus on air handling systems installed for food factory building ventilation and air quality control. The aim is to provide food producers with a solid grounding in the fundamentals of air handling and the role it plays in building ventilation,

## ABOUT THE AUTHOR



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producers realise desired cost-, production- and energy-saving efficiencies throughout processing, storage and packaging areas within the facility.

EHEDG Doc 47 offers several key insights that highlight how food producers can attain these benefits and meet the air quality and hygienic requirements of the food manufacturing process. Key takeaway messages in the guideline include the following:

### **DO plan for hygienic design**

Building design and the air handling system design are closely linked to each other and should be planned and designed with an integral approach. It is essential that the planning and design of all elements of a food manufacturing site that impact or contribute to hygiene are well balanced and based on a fully integrated, overall hygiene concept.

**“ Air filters are the critical element in maintaining clean and hygienic conditions within air handling systems ”**



to achieve optimal design and application in relation to product risk categories. Specifically, the guidelines cover the choice of systems, air filtration types, system concepts, construction, maintenance, sanitation, testing, commissioning, validation and system monitoring.

The ability to control the properties of air – particularly temperature, humidity and cleanliness – as well as airflow throughout the food plant, has a direct impact on a manufacturer's ability to manage and control the risks associated with airborne contaminants. Effective air handling control systems and protocols can also help food

### **DO assess risk and use hygiene zones**

Airborne contamination may be reduced in several ways, depending on the facility layout, the type and risk levels of products manufactured, and other factors. It is important from the outset to understand the risk category of the product to be manufactured in a controlled space. Where possible, manufacturing should be segregated into zones based on the level of hygiene (ie, separate locations/factories or by separation of operations within the same factory). Contamination can also be controlled by enclosed systems, partition, air flow, time with effective intermediate ➤



**“ EHEDG Doc 47 offers food producers a thorough insight into the dos and don'ts of designing, selecting, installing and operating air handling systems ”**

cleaning and, where appropriate, disinfection or other effective means.

#### **DO install the right equipment for the job**

Air handling unit components such as the fan and motor set, heating and cooling coils, filter frames, diffusers and dampers, should be designed, manufactured and installed to ensure a long service life – particularly when operating in damp and dusty environments. Air handling units, air filters and air filter stages must be designed to minimise the carryover of microorganisms or inorganic and organic dusts to downstream components, or into the space to which air is supplied, during operation or any maintenance activity such as filter installation, inspection or change. It is recommended that food producers work closely with their air handling equipment and component suppliers to ensure that these systems deliver optimal performance for the specific production environment.

#### **DO focus on effective filtration**

Air filters are the critical element in maintaining clean and hygienic conditions within air handling systems. It is an established fact that it is cost effective to install and service good quality air filtration by using at least two filter stages. Air filters should be examined periodically to ensure the filter performance is maintained and should be changed, at the latest, if the permissible final pressure drop has been reached or when technical and/or hygiene deficiencies are observed.

#### **DON'T forget to check the H<sub>2</sub>O**

All water-carrying parts and permanently wet parts of humidifiers and heat exchangers require periodic inspection, cleaning, and disinfection, if necessary. For example, water supplied to a humidifier must comply with World Health Organization drinking water guidelines, and other water quality requirements may also apply, such as in cases where extract air may affect the supply air.


#### **DON'T bypass cleaning and maintenance basics**

It is necessary to inspect the air handling system regularly and maintain it properly. Regular cleaning, disinfecting and hygiene procedures are essential for the hygienic operation of air handling systems. It is critically important to understand the impact of cleaning chemicals, detergents and disinfectants on air handling units, particularly with respect to corrosion or ineffective removal of organic and inorganic contaminants from air ducts, evaporators, motors, filter housings, etc. To meet the hygiene requirements and avoid corrosion, the cleaning regimes should be adjusted according to the defined hygienic requirements. Again, the food producer should work closely with cleaning chemical and treatment professionals to ensure that cleaning products are suitable for their facilities' air handling systems.

#### **DO create an air quality manual**

Air handling equipment is usually located in ceiling voids away from the daily operations of the food factory. With this in mind – and the often infrequent attention to such equipment – it is important to document the air handling specification and scope of operation and maintenance to ensure best practice and maintain operating performance. A manual of documents can be referred to as an air quality manual.

#### **Achieving airtight hygiene**

EHEDG Doc 47's comprehensive review of air quality controls for building ventilation provides a solid basis for ensuring airtight hygiene in the food processing plant. The guidelines emphasise the importance of strategic hygiene planning when it comes to air handling units and systems, particularly since maintenance and cleaning activities can cause downtime for production lines. Implementing measurable air handling systems and monitoring protocols will not only help ensure that food is produced to the highest safety standards, but will assist manufacturers in achieving efficiencies that positively impact the bottom line. 

For more information about the EHEDG Doc 47 guideline, please visit [www.ehedg.org](http://www.ehedg.org).



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# UNITED KINGDOM

The UK food industry has always relied more on manual labour than our European competitors. Now the UK has to start taking automation seriously if it is to compete effectively in world markets. Rob Chester, Managing Director of Food for NSF International in the UK, considers the implications for food safety.

In the competitive world of wine, the UK ranks as one of the smallest regions, but arguably it is one of the most exciting, attracting not only plenty of attention over here but also making its mark internationally. The future is looking bright for British wines, says Julia Trustram Eve, Marketing Director for Wines of Great Britain.

Independent craft beer is the UK's biggest drinks trend. Neil Walker, PR and Marketing Manager for the Society of Independent Brewers, explains the healthy state of the UK craft beer market.



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# Labour and the role of automation in food safety

The UK food industry has always relied more on manual labour than our European competitors. Now the UK has to start taking automation seriously if it is to compete effectively in world markets. **Rob Chester**, Managing Director of Food for NSF International in the UK, considers the implications for food safety.

IN THE face of Brexit and the new competitive challenges for the UK, the government has signalled its determination to support modernisation and technology development. Chancellor of the Exchequer Philip Hammond has pledged more than £500m for digital, data and technology projects, including artificial intelligence. Michael Gove, Secretary of State for Environment, Food and Rural Affairs, gave a strongly worded message to the food industry recently, saying we must not rely on low-skilled labour or we will be overtaken by others who do invest in automation.

Productivity is the name of the game and Brexit has thrown this sharply into focus. The average German worker can make £1.35 in the time it takes a British worker to make £1. But why is the UK behind the rest of Europe when it comes to automation? In 2016, the UK took delivery of just under 2% of global industrial robots for food and beverage production, compared to France and Germany at 5% and 6% respectively. In France, and to a lesser extent Germany, restrictions on working hours and limits on redundancies make hiring workers more costly than in the UK. This encourages French and German firms to invest in the latest machinery and limit employment.

It also appears that in the UK we have a more cautious (some may say more short-sighted) view of return on investment. Payback periods are often as little as one year, meaning that installing expensive capital equipment is not a good option when the work can be done instead by cheap labour.

However, all that is now changing.

The Office for National Statistics said last August that net migration had fallen to its lowest level for three years, with more than half the drop caused by European Union citizens leaving and fewer arriving since the Brexit vote. According to the Association of Labour Providers, 70% of labour providers to the agriculture, food manufacturing and distribution sectors are unable to meet all their clients' labour needs and 36% of labour providers were not expecting to be able to source and supply sufficient workers for Christmas 2017.

In fact, this is not simply a UK or Brexit problem; quality of life has improved in many countries that have until now been good sources of labour for the UK, France and Germany, and people are less willing to move. The population is ageing and there are increasingly onerous responsibilities and therefore costs for employers. The introduction of the new National Living Wage will raise the minimum wage by 4.4%.

## Investing in automation

In these circumstances investment in automated systems starts to look like a sensible option. A recent survey by the Agriculture and Horticulture Development Board reported that many growers see robotics as a solution to labour availability issues, with a third of respondents saying they had begun developing their own in-house solutions, and a further third already involved in R&D projects. The most recent advances in automation have

“A cutting and knife cleaning procedure that previously took five minutes now takes 17 seconds using new robotic equipment, and now takes the place of 10 workers”



been in planting, harvesting and grading. Almost a third of growers use 'some element of robotics', incorporating feedback and sensing.

Mike Wilson, Chairman of the British Automation and Robots Association, explains that sophisticated systems incorporating robots can already undertake tasks ranging from picking and wrapping pancakes to handling and packing eggs. He says: "Automatic handling of primary food still presents challenges, because it is not uniform in size and shape and it is less easy to control where it is on the line, but manufacturers are now developing vision-control systems that can cope with this."

Using robot-controlled automated systems makes sense in terms of productivity, food safety, and health and safety. Machines are faster and more precise. Each robot can carry out 110 to 140 picks per minute. A UK business, Boomf, which makes personalised marshmallow confectionery, reports that a cutting and knife cleaning procedure that previously took five minutes now takes 17 seconds using new robotic equipment, and now takes the place of 10 workers.

Removing the human element takes out potential food safety problems such as poor handwashing, transmission of foodborne disease and infection between workers. Packing, lifting and palletising heavy boxes also represents health and safety risks to workers such as repetitive strain and back injuries. One of the biggest egg-producing farms in Thailand has raised its productivity by 30% by using a robotic system that stacks heavy boxes and baskets of eggs onto pallets. Before this, workers would manually stack the cartons and baskets of eggs onto the pallets, with a single worker lifting about 15 tons of eggs a day.

Similarly, automated systems have the advantages of being able to function in environments that are risky for humans, such as in extreme temperatures or precarious heights. However, use of these automated systems does bring its own hygiene problems.

### Hygiene challenges

At NSF International, we offer globally respected certification and registration programmes for verifying the hygienic quality of commercial foodservice equipment. These are important for export markets, and essential for North America. Ann Willems, the NSF Food Equipment Manager in Europe, reports that although the numbers of machines incorporating robotics are still small, they can present significant challenges in terms of acceptability in the American markets: "We are increasingly seeing systems like automated pizza-making and chip-frying vending machines, 3-D printers or precision cutting tools with sensors such as for kebabs or fancy cake-cutting. As equipment becomes more sophisticated with more

### EXPERT VIEW



**Peter Walker**  
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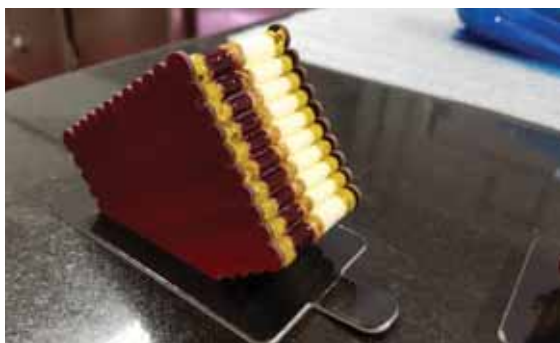
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Written by Minebea Intec's own Microsoft-certified software engineers, the package integrates seamlessly into the customer's network and can be installed on all Windows operating systems from Windows 7 onwards. The look and intuitive operation will be familiar to users of Microsoft Office applications, making the implementation very easy for a new user. ■





**ABOVE:** The Hydroprocess ChefCut cake cutter. This system uses precision water jets to cut intricate custom shapes in cakes and chocolates (right). Machines such as this one can cut more safely and with less waste than a human, but are complex to render compliant with US regulatory requirements for hygiene and cleanability.



moving parts, cables, openings, etc, they become more difficult to dismantle and clean. They also use more lubricants."

It is a requirement that the machines can be manually cleaned without specialist equipment in a commercial kitchen or restaurant environment. Operators can often be unskilled or non-English speaking, and machines must be simple to clean and designed to minimise contact between the motor parts and the food zone. Ms Willems says: "Cleanability is often the last thing considered by the system designers. We would urge any manufacturer to involve the certification body at an early stage. Too often we have seen time and money wasted when machines need to undergo costly design updates to meet US public health requirements."

Mr Wilson also emphasises that you cannot totally remove the human element from industrial systems. "Robots are highly reliable and rarely fail, but problems may be caused, for example, by a faulty sensor or a moving part. In that instance a backup manual process may be needed. Humans are still needed to monitor equipment as it works, carry out preventative maintenance and troubleshoot if there are problems." Training is key. If an operator mistakenly removes filters from a commercial dishwashing machine, hygiene is totally compromised.

"Common sense is still required," says Ms Willems. "The software may be telling you the oven is baking at the right temperature, but a visual check may prove different."

Remote sensor monitoring on equipment now provides accuracy and control in areas where human record-keeping has proven to be all too fallible. Monitoring fridge and oven temperatures and humidity is already common practice and sophisticated industrial machinery often operates with remote monitoring and diagnostics provided by the system builder. But what happens if the internet connection goes down? Mr Wilson says: "We still rely on people being able to pick up the phone or make a visit when things go wrong."

In many ways we are just at the start of discovering how technology can enhance food


safety. There are many developments facilitated by technology that have obvious potential for applications in food. Examples include monitoring and control of handwashing via wearable sensors and intelligent packaging that warns when a product is about to go out of date. Smart wearables will soon enable us to monitor the health signals of workers in food preparation areas, in order to spot when they may be ill. We are also seeing a growing use of portable devices, such as hyperspectral cameras that can accurately assess in an instant the composition of a product, taking the place of expensive and slow lab testing.

## Transforming auditing

Auditing of multi-outlet manufacturing and retail chains is an expensive, resource-hungry activity. Auditing all sites on the same set frequency, whether they are good or bad, is not very efficient or effective. We can now use predictive analytics to understand how and where risks are arising in our own or supplier sites and to schedule preventative activity on a targeted and prioritised basis. NSF International is already doing this for a number of clients.

We have spent more than two years developing a remote auditing system called EyeSucceed. An operator not trained in food safety can conduct an audit wearing smart glasses anywhere in the world, while a trained auditor back in the UK office can see what they see, direct the audit and communicate with the wearer from the comfort of their own desk. The savings from not having to send auditors to distant parts of the world will be huge. But even more exciting is the potential that the glasses have to help train people and ensure they are following correct practices. You can embed routines into the glasses so that people doing critical tasks on production lines can obtain guidance and correction instantaneously.

Perhaps the most exciting possibility is being able to draw on global knowledge to build better food safety practices. Every business involved in the food industry is creating policies and processes to define and control key aspects of what they do. There is a worldwide database of food industry practice in the manuals of every business and in the head of every expert. Why can't the food safety industry harness that?

The possibilities are endless. Technology is a wonderful thing. However, running through every thread of technology is the human story. Machines will still, for a long time at least, need operators of some sort. Food-producing businesses still need leadership and the fostering of healthy cultures to avoid malpractice and maintain high standards. Embraced effectively, technology can be a big part of the solution. But as famous management consultant Peter Drucker once said: "Culture eats strategy for breakfast." I'll always put my money on that. 

## ABOUT THE AUTHOR



**ROB CHESTER** is UK Managing Director of Food at NSF International, leading its food safety services and operations. Before joining NSF he worked for Walmart in the UK, the US and China. While in China he was the Chief Compliance Officer, and in the US he ran Operations Compliance across Walmart's 5,000 US stores. Prior to Walmart he held several global compliance roles for Tesco. He holds an LLB and postgraduate diploma in Legal Practice from the University of Central Lancashire.

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## Discovering the wines of Great Britain

In the competitive world of wine, the UK ranks as one of the smallest regions, but arguably it is one of the most exciting, attracting not only plenty of attention over here but also making its mark internationally. The future is looking bright for British wines, says *Julia Trustram Eve*, Marketing Director for Wines of Great Britain.

**T**HERE are now over 500 vineyards in the UK, most located across southern England, but also stretching up through the Midlands and East Anglia to Yorkshire, and in north and south Wales. These range from large commercial operations to small, family-run vineyards.

Although vine growing in the UK goes back to Roman times, it is only since the 1950s that a commercial industry has developed. Those few hundred acres have grown to over 5,000, and more vineyards are being planted every year. In the last 10 years, acreage has more than doubled, and nearly tripled since 2000. Average annual

production is now around five million bottles and, with increased planting is predicted to grow to some 10 million by 2020, continuing to many more in the decades to come.

All of this means that we will be seeing much more English and Welsh wine in the coming years. This remains a small region in the world of wine however – our wines currently account for less than 1% of the overall total of wines consumed in the UK.

Sparkling wines account for about two-thirds to three-quarters of the country's total wine production, and this is the style that is leading the UK's reputation nationally and internationally.



Competition wins over the last 20 years or so have shown the consistency and quality of the UK's wines when tasted against their peers of the wine world.

### A sparkling investment

Most sparkling wines in Great Britain are produced from the same varieties grown in Champagne (Chardonnay, Pinot Noir and Pinot Meunier). Their finesse and longevity are proving themselves year upon year on the world stage in blind tastings and competitions. Even Champagne houses are investing in England; Taittinger planted its first acres in Kent last year (named Domaine Evremond) and Vranken Pommery has invested in Hampshire – proof of the confidence in this wine region from some of the giants of the world of sparkling wine.

Other grape varieties are also used in sparkling wine production, enabling vineyards across the country perhaps less suited to growing Chardonnay and Pinot Noir to produce their distinctive and fresh styles. In all cases, these wines are currently produced using the same, highest quality method of sparkling production that produces Champagne. Look for the words 'English (or Welsh) Quality Sparkling Wine' on the label and you are assured that it has been produced to the highest standards.

Great Britain's still wines are also worth discovering, and include a wide range of styles from dry to medium-dry whites, refreshing rosés, luscious dessert wines and fruity reds. White wine dominates this sector, producing crisp, clean and fresh wines. Aromatic varieties suited to the cool climate of Great Britain thrive here. The most popular of the white wine varieties is the aptly-named Bacchus,

which together with other varieties grown in England and Wales, and even starting to appear in Scotland, has its origins in Germany. In the UK, however, Bacchus takes on a character of its own, exuding aromatic, fresh, crisp and gooseberry notes. It is now the third most planted grape variety in the UK after Chardonnay and Pinot Noir.

More familiar-sounding varieties such as Pinot Gris, Pinot Noir and Chardonnay are also producing still wines and are growing in number. Generally, still wines from Great Britain tend to be lighter in style and alcohol, ranging from 11-12.5%.

### Climate challenges

Much of this is of course down to the climatic conditions in which grapes are grown. The UK remains on the northern reaches deemed acceptable for grape growing, possessing its fair ➤

**“ Most sparkling wines in Great Britain are produced from the same varieties grown in Champagne (Chardonnay, Pinot Noir and Pinot Meunier) ”**



Credit: Rathliff Estate



Credit: Borey Wine Estate



Credit: Jenyn Rice

**“ Climate change is playing its part in the UK wine industry's development ”**

share of climatic challenges, which include the risk of late frosts, low temperatures, high rainfall and disease. However, it is certainly not alone by any means in coping with the vagaries of the weather. Vineyards across the world face their own challenges and all take appropriate measures to mitigate too much damage.

Climate change is playing its part in the UK wine industry's development. Around 40 years ago, vineyards were harvesting their grapes about a fortnight later than they do today. Those grape varieties that have put England and Wales on the map – such as Chardonnay and Pinot Noir – could not have grown as successfully back then as they do now. The grape growers know that as a cool climate region they need to cope with whatever the weather brings, but they also know that the resulting wines carry a unique quality and style. A cooler climate means higher acidity – nature's great preservative. A long, slow ripening period for the fruit extracts delicate fruit flavours and a freshness that remains in the wine.

The ever-growing interest in, and a following for, regional food and drink, is undoubtedly exciting consumers to look more to what is produced on their own doorstep. This holds many opportunities for retailers and caterers alike to work with the extraordinarily diverse and high-quality ingredients and producers and to tell their story. In the same way that we look to our continental cousins for sublime food and wine pairings synonymous

with their region, so there are huge opportunities to do the same with Britain's food and drink. Think Whitstable oysters and sparkling wine from Kent; salt marsh lamb with a light and fruity Sussex Pinot Noir, and Stilton accompanied by one of our luscious dessert wines. The possibilities are endless for restaurants and retailers alike.

English and Welsh wines are now widely available, having been embraced by the wholesale and retail wine trade. Several supermarkets now have their own-label English wines – Waitrose even has its own English vineyard – while others seek to list wines that are local to their branches. Independent retailers can hand sell, engaging their customers with the story of the producer, just as they do with any other gem on their shelves. Many wholesale suppliers to the restaurant and catering trade now list English wines, which opens up more accessibility to more local wines. Suppliers have a real opportunity to introduce a home-grown wine to an increasingly aware customer who is interested to know more.

Of course, the vineyards themselves can supply direct. A growing number are also open to the public – well over 100 across the country offer cellar door sales and include other tourism facilities besides. They are part of an exciting tourism hub in our countryside and are making a growing contribution to the rural economy, either as a tourism outlet in their own right, or engaging with many outlets that are. ➤

## ABOUT THE AUTHOR

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## EXPERT VIEW



**Nina Spencer**  
Commercial Manager,  
Premier Analytical Services

## The key to lactose detection

**Continued growth in the Free-From category makes expert detection of low-level lactose a vital service for manufacturers**

Some food trends explode then are over as soon as they've begun, but the Free-From food category is continuing to grow exponentially – thankfully for those who suffer from allergies and intolerances. Although gluten-free might be the most common, there have also been great strides in terms of low-level lactose products being brought into the market.

Milk (including lactose) is one of the 14 allergens whose declaration is mandated based on the regulatory list in Annex II of European Legislation EU 1169/2011. Lactose is a naturally occurring sugar found primarily in dairy products, which requires an enzyme called lactase to be digested. Lactase breaks the sugar lactose into two sugars, glucose and galactose, which are absorbed into the bloodstream. If your body does not produce enough lactase, then you are deemed to be lactose intolerant.

Lactose intolerance means you cannot break down the lactose, therefore it stays in your system, becoming fermented by bacteria in the gut. This fermentation leads to the production of various gases, which in turn cause symptoms including abdominal pain, bloating, and many more.

Because lactose is a sugar, the analysis required for its detection cannot be approached in the same way as with most allergens – which are usually protein based and therefore utilise detection via ELISA or PCR. Thanks to the development of alternative analysis methods we have seen increased growth in this product category – those developing new products with low-level lactose will be able to demonstrate that they indeed have these low levels. This enables those with an intolerance to purchase products with confidence that they should not cause any adverse reactions.

PAS offer UKAS accredited analysis for low-level lactose (level of detection of 50ppm) following a method that determines lactose by ion-exchange chromatography with specific electrochemical detection. ■



Credit: Denbies Wine Estate

Another growing market is overseas, with English and Welsh wines now being exported to some 30 different countries across the world. The main focus for the next year will be the US, which is the biggest single growing market.

Given the overall volumes produced, English and Welsh wines are not setting out to compete on price or volume with the large-scale production seen from other countries. They are more akin to the smaller regions producing wines of a top-quality reputation with higher price points to match. The reputation of these regions' wines is forged over a long period and takes years of brand and collective marketing to sustain that position in the minds of the consumer. Trends come and go, but a long-term reputation requires focus, diligence, and a collective commitment from the producers.

Great Britain has the potential to carve out a similar reputation for quality and style as some more famous wine regions. This now rests with the newly formed industry organisation for the wine industry, Wines of Great Britain (WineGB, winegb.co.uk), and the many vineyards and producers who are part of it. It is a challenge, but presents an exciting and almost unique opportunity.

This year, WineGB is commissioning a survey of vineyards and wineries and will be announcing some detailed figures on production, forecast growth, potential for expansion and economic contribution to the workforce, agriculture and tourism. This will set the scene for where the industry is today and demonstrate what a significant growth sector it can become.

In a country that sells one of the widest ranges of wines from across the globe, the wines produced here are a noteworthy success story, and have the potential to play a significant part in our food and drink industry. Now that is surely something to raise a glass to. ■



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## Independent craft beer: the UK's biggest drinks trend

*Neil Walker*, PR and Marketing Manager for the Society of Independent Brewers, explains the healthy state of the UK craft beer market.

**F**OR the fourth year in a row, the Society of Independent Brewers (SIBA) will this year team up with Professor Ignazio Cabras from the Newcastle Business School at the University of Northumbria to gather and analyse data on the independent craft brewing market. With over 500 breweries across the UK represented, this is the most comprehensive analysis of the craft brewing market available in the UK and makes some important observations about the current

state and future of the industry. The results of the 2018 report are due to be announced later this year but this article sets out the shape of the market right now, as outlined in the 2017 report, showing the healthy growth and investment being made into this important industry – as well as the opportunities and threats that can be expected.

Independent craft brewers involved in the survey produced over 299 million pints in 2016, which is estimated to be around 527 million pints for ➤



**“More than a third of people would visit restaurants more often if they served independent craft beer”**

#### ABOUT THE AUTHOR



**NEIL WALKER** is PR and Marketing Manager for the Society of Independent Brewers (SIBA).

all SIBA members, or nearly 3 million hectolitres. This represents a 13.7% increase in the period 2013-2016, which is an impressive achievement given that the UK beer market overall has been in long-term decline.

What this shows is that the one area of the market that is growing is craft beer. Britain's beer drinkers continue to demand craft-brewed beer that offers quality, excitement, and a range of flavours and styles in cask, keg, bottle and can. Quality, independently brewed local beer continues to be important for beer drinkers, with 65% of SIBA members' beer being sold within 40 miles of the brewery. What is also quite clear is that, like pubs, brewers are embedded in their communities. And SIBA members are creating plenty of local jobs, with 71% of brewers expecting to recruit at least one new employee in the next 12 months.

This shows that craft beer is as much about communities and identity as it is about beer – people are buying local, and independent craft beer is an important part of this.

#### Craft beer for restaurants and hospitality

While cask ale is by far the most prominent category for our members, at 74% of production, it is interesting to see that 37% of respondents are now selling some craft beer in keg, which is a significant increase on the 27% reported in the 2016 report. This is an important trend and one to celebrate.

Great beer transcends format and provides the opportunity to provide a unique selling point for pubs through cask ale, alongside pushing beer of excellence deeper into the off-trade and into hospitality outlets such as hotels, clubs and restaurants. The opportunities for independents' beer are no longer restricted by format and there is no reason that businesses of all types cannot make the most of the consumer trend for independent craft beer.

In fact, research by industry experts M&C Allegra shows that more than a third of people would visit restaurants more often if they served independent craft beer, and for retailers that is important, as further research from drinks industry specialists CGA Strategy showed that independent craft beer commands higher margins than mass-produced beers for bars and restaurants.

#### The importance of independence

In 2016, SIBA launched an initiative to promote 'Assured independent British craft breweries' in an effort to provide greater clarity for consumers looking to purchase beer from genuinely independent craft breweries in the UK. With over 850 brewing members in the UK, SIBA is the voice of British brewing and we launched the initiative to champion the huge range of fantastic, full-flavoured beers from truly independent local breweries which have captured the excitement of the beer-drinking public. As the 'craft beer' category has moved into mainstream retailing, beer drinkers need more information to help them make informed choices.

Market research commissioned by SIBA showed that 46% of beer drinkers, by far the biggest group, regard craft beer as 'made by small brewers rather than large corporations'. And 35% regard craft breweries as 'artisanal', with 22% associating the term with 'small' and 14% with 'local'.

The passion and innovation of independent brewers, together with increasing consumer demand for diversity, provenance and excellence, created the craft beer revolution, the biggest thing to have happened to British beer for many years and which helped to revitalise the UK beer market and turn it into the most exciting beer scene in the World. Hundreds of passionate and genuine independent brewers have brought thousands of world-class beers to communities across the UK.

#### Who brews my beer?

As the craft beer market has grown it has been flooded with beers from across the world, often from large global brewers. As such, SIBA launched the 'Assured' initiative to help consumers make informed decisions about where their beer comes from and who brewed it. ➤



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## EXPERT VIEW



**Alison Johnson**  
Managing Director,  
Food Forensics

## Isotope testing – what to do with the results?

Stable isotope ratio analysis is now widely used to test for consistency with claimed origin and/or production system (organic, free range egg, etc), and can highlight potential food fraud issues.

Stable isotope ratio analysis testing is a signpost for further investigation. It does not automatically mean the sample is mislabelled or adulterated. If the isotopic profiles are not what is expected this is the trigger to ask more questions:

- Ask for the paper traceability – is it what you expected? Testing should be designed to complement other traceability systems.
- Is there anything unusual about the source or is any part of the supply chain handling other origins? If so, what segregation processes are in place (investigate as if it is an allergen cross contamination – do not forget reworks, end of runs and NPD!)
- Can you sample from the supplying source? This allows you to batch match – a check to see if the sample matches, and did it come from where the paper traceability states?

There are only ever three potential reasons a sample will flag on origin/production system testing:

1. It did not come from where it says it has (or has not been produced in the manner stated)
2. There has been a change in the production system that is not represented in the reference dataset
3. The production method/region is underrepresented in the reference dataset.

At Food Forensics we invest extensively in reference datasets and their integrity. Most of the samples in our reference datasets are primary reference samples (collected at source by Food Forensics staff). We understand agriculture, agronomy, animal and plant nutrition and production practices, as well as supply chains. This enables us to advise on the right questions to ask and help support follow-up investigations.

To get the maximum gain from this testing, tell your supplier you are testing, engage with them on the investigation, ask Food Forensics for guidance on investigation follow-up, then retest! ■

In order to qualify for the stamp of approval, breweries must be relatively small, independent, and brewing quality beer (something which is set out in more detail for brewers seeking to use the seal).

The initiative makes it easier for beer drinkers to identify beers from SIBA independent craft breweries quickly and easily, whether they're buying beer in a pub or bar, off-licence or supermarket. It is an initiative that has now been mirrored by our equivalent organisation in the US – the Brewers Association – with its 'independent craft brewers' seal. New research published in 2017 by SIBA showed the majority of beer drinkers want greater clarity over who is brewing the beer they drink, following an increase in the popularity of craft beer and a number of buyouts of independent craft breweries by global brewers.

The independent YouGov survey of more than 1,000 beer drinkers showed a large majority (60%) of beer drinkers cared who brewed their beer and more than two-thirds (69%) thought it would be useful to see the logo on beer pump clips, bottles and cans, in order to identify the beer as being brewed by a truly independent craft brewer, rather than a global beer company. More than half (54%) went even further and said that they would be more likely to drink a beer which carried the logo.

Quality, flavoursome beer from independent British craft breweries has never been in greater demand, with more people than ever drinking more discerningly and choosing full-flavoured beer. This has of course attracted the attention of the global brewers, who have been buying out previously independent breweries and trying to get their own slice of this growing sector.

This survey clearly shows that consumers care whether the beer they are drinking was brewed by a truly independent British craft brewer or not – it is all about provenance, transparency, and not misleading consumers. The research also showed that half of beer drinkers (50%) were now drinking 'local craft beer', with this number rising to 61% for 25-34 year olds, suggesting a healthy future for this important British manufacturing industry.

Buyouts of previously independent craft breweries such as Camden Town by AB InBev – the makers of Budweiser – and London Fields by Carlsberg, have brought into focus the need for clarity in the beer world. SIBA's 'Assured independent British craft brewer' seal was introduced as a way for truly independent craft breweries to differentiate the beers they brew from mass-produced products and has been met with huge praise by brewers and consumers alike.

If you're not already making the most of the consumer trend towards craft beer then do it now, but make sure it is the real stuff – brewed by an Assured independent British craft brewer. ■

# EVENTS DIARY

Keeping you up to date with upcoming events in the food and beverage industry



february

18

**Gulfood**

Date: 18-22 February  
Location: Dubai, UAE



26

**Pittcon**

Date: 26 February - 1 March  
Location: Orlando, USA



march

01

**Food Fraud**

**Food Fraud 2018**

Date: 1 March  
Location: London, UK



12

**World Mycotoxin Forum 2018**

Date: 12-14 March  
Location: Amsterdam, The Netherlands



20

**Aunga FoodTec 2018**

Date: 20-23 March  
Location: Cologne, Germany



april

10

**Analytica**

Date: 10-13 April  
Location: Munich, Germany



may

15

**Vitafoods**

Date: 15-17 May  
Location: Geneva, Switzerland



For more information about other industry events, go to:

[newfoodmagazine.com/events](http://newfoodmagazine.com/events)

Anuga FoodTec

Cologne | Hall 10.2  
Booth C-090-D-099

analytica

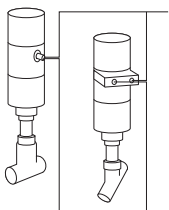
Munich | Hall A1  
Booth 307

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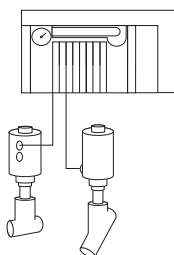
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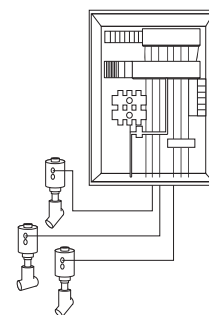
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