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# Detecting food authenticity and integrity

David I. Ellis* and Royston Goodacre

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Welcome to this joint *Analyst* and *Analytical Methods* web themed collection which showcases some of the current developments, as well as the future perspectives and potential, for the detection of food authenticity and integrity using modern bioanalytical approaches (http://rsc.li/1EWq29y). It is three years since the horsemeat scandal of early 2013, which has been said to have sent shockwaves across the food industry,[1] not only in the UK and Europe where it was centred, but across the globe; as a result of substitution of horsemeat for beef in many well-known products, consumers lost confidence in many retail outlets. This instigated the UK Government to establish an independent enquiry into this event and in 2014 the Elliott Review was released;[2] we are delighted to have the highly respected author of that review, Prof. Chris Elliott from Queens University Belfast, contributing to two articles within this themed collection. The so-called 'Horsegate' scandal across Europe, and the earlier melamine crisis of 2008 – which led to fatalities and multiple hospitalisations and had a long international reach – are only the latest in a long line of known food safety scandals of the last few decades, some of which are detailed in the introduction to our earlier review on Fingerprinting Food published in 2012, the year prior to Horsegate, in *Chemical Society Reviews*. This review continues to be well received amongst the analytical and broader community, the media, and those interested in the rapid detection of food adulteration and contamination.[3] At that time in 2012 we said that these large-scale food adulteration and contamination events are partly as a result of globalisation and rapid distribution systems which can have far-reaching and international consequences, evidenced less than a year later by Horsegate. Horsegate was a large-scale food adulteration/contamination event and, on this occasion at least, very fortunately did not have lethal consequences. By contrast, the melamine event and multiple other incidents, such as Spanish toxic oil syndrome for example, did lead to the loss of life.

What is evident is that these major food adulteration and contamination events occur with alarming regularity and are known to be episodic, with the question being not *if* but *when* another large-scale food safety/integrity event will occur.[4] It is with this statement that we opened our most recent Critical Review in this area, which can be found within this themed collection and which focuses on rapid handheld technologies for food fraud (and food analysis in general), with a future perspective of combining and improving upon these technologies with predictive computational (as well as other) methods, and moving them out of laboratories and into food supply chains.

There are several other articles in this themed collection with a spectroscopic focus, including UV,[5] Raman and infrared technologies which are detailed in a Minireview by Daniel Cozzolino from Australia,[6] portable mid-infrared spectroscopic investigations from Luis Rodriguez-Saona,[7] two surface-enhanced Raman scattering (SERS) articles by Lili He and co-workers from the USA and China, one of which combines colorimetric detection with SERS for pesticide detection,[8,9] and NIR hyperspectral imaging approaches from Mohammed Kamruzzaman from Bangladesh together with co-workers from Japan[10] amongst others. Of course, many other approaches in addition to spectroscopy are as expected very much in evidence within the collection, such as mass spectrometry and/or chromatographic techniques;[11–13] genomics,[14–17] with at least one of these articles concerning the detection of horse DNA in meats,[16] ELISA,[18–20] as well as molecular imprinted polymer-based chemiluminescence.[21]

As this collection is dedicated to showcasing detection methods for food authenticity and integrity, it covers a broad range of equally important areas in addition to those dedicated to food fraud/adulteration, such as the measurement of compounds as food quality indicators, as in the case of a cyclic aldehyde

*Manchester Institute of Biotechnology, School of Chemistry, University of Manchester, UK, M1 7DN. E-mail: D.Ellis@manchester.ac.uk*

for honey for example,[22] whereas others focus on contamination by unwanted compounds, whether this contamination is intentional or inadvertent, and this is exemplified *via* an especially relevant, timely, and important Critical Review on supply chain risk and the urgent analytical needs required for food allergens[23] – authored by internationally recognized experts in this field including Prof. Clare Mills from the Manchester Institute of Biotechnology, with colleagues including Michael Walker from the UK Government Chemist, Allergy Action, and Prof. Chris Elliott, founding Director of the Institute of Global Food Security in Belfast.

Other articles concerned with chemical contaminants include, perhaps not surprisingly, those on the detection of the now infamous plasticizer melamine,[9] pesticides,[13] hazardous dyes,[11] fungicides,[19] drug and preservative residues,[18,21] multiple adulterants of milk, including chloride, starch and sucrose,[24] as well as heterocyclic aromatic amines formed when heating protein-rich foods,[12] the latter having received considerable attention and debate of late due to the mutagenic and carcinogenic potential of the compounds concerned. Of course foods can be subject to bacterial contamination (as well as spoilage) and the detection of perhaps two of the most well-known foodborne pathogens, *Salmonella* species[20] and *Campylobacter* spp.[25] are also included, as well as enterobacterial plant pathogens in important food crops for food security diagnostics.[17]

It is our sincere hope that the results of this growing web themed collection are two-fold: first, that the collection will have a positive impact, add to knowledge, and provoke further discussion, debate, and research within the field and related areas; and second, that the collection assists in raising awareness within this vitally important and emerging area of detecting food authenticity and integrity, a field which is of genuine interest to us all as consumers of food products (a commodity we spend a significant proportion of our income on), and will hopefully contribute in helping to achieve the goal of more resilient and sustainable food systems, and increasing food security. Finally, we would very much like to thank all contributing authors to the themed collection, as well as Matt Cude, Rebecca Brodie and all at the RSC for their continued support. We hope you enjoy the collection!

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