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EDITORIAL

Food safety analysis

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Safety, availability, and nutrition of food ranks among the fundamental needs for human life (along with personal security, potable water, warmth, and shelter). The first food safety intervention techniques of cooking, smoking, and salting foods contributed tremendously to human development. Food safety is no less important today than ever, and the safeguards to reduce pathogens, toxins, toxic elements and other deleterious contaminants in our food supply has helped improve human health and increase the length and quality of lives. The health and economics of food animals also depends on the safety of their feed, which is converted to protein for benefits in many diets.

Established long before even the simplest intervention techniques, "analysis" constitutes the primary component in food safety systems. The earliest food safety detection methods are still by far the most frequently used, which consist of visual inspection, smell, and taste, followed by bioassay through ingestion. These tests are easily performed even by infants, but professional food inspectors and tasters require much training and experience to perform them well. All unwasted food is inspected at least once through these traditional means, which combined with both old and new food quality and control measures, continues to reduce incidences of acute food poisoning and chronic health conditions.

In 1820, Frederick Accum wrote a seminal publication about food safety analysis [1]: *A Treatise on Adulteration of Food, and Culinary Poisons, exhibiting the Fraudulent Sophistications of Bread, Beer, Wine, Spirituous Liquors, Tea, Coffee, Cream, Confectionery, Vinegar, Mustard, Pepper, Cheese, Olive Oil, Pickles, and Other Articles Employed in Domestic Economy, and Methods of Detecting them*. Decades later, a series of food safety laws were established in the UK and other countries in Europe.

In 1878, Harvey Wiley traveled from the US to Germany to study sugar chemistry, which gave him the experience to conduct adulteration analysis of sugars and syrups upon his return. His sustained efforts, and Upton Sinclair's *The Jungle*, were instrumental in establishing the first of a series of food safety laws starting in 1906 in the US. Since that time, life expectancy of the US population rose from age 47 to 79, and cause of death due to infectious diseases dropped from 53 to 3% [2]. The latest estimate by the US Centers for Disease Control and Prevention is "that each year 48 million people get sick from a foodborne illness, 128,000 are hospitalized, and 3,000 die" [3]. These figures are 40–60% lower than estimates made just 2 decades ago [4], which substantiates the major efforts made since passage of the Food Quality Protection Act in 1996 and Food Safety Modernization Act in 2011.

Laws and regulations without enforcement are merely license, and monitoring of regulated and illegal substances in foods is an essential component in food safety systems worldwide. Enforcement actions nearly always rely on analytical results as evidence, and since lives and livelihoods are often at stake, the methods used must be demonstrated to yield accurate and valid results. These analyses not only help protect human and animal health, but are also intended to protect the environment and ecosystem from improper use of agrochemicals. Providing a disincentive to improper practices also benefits food producers who follow the rules.

To make informed decisions about currently regulated, emerging, and/or unknown adulterants, accurate monitoring results are needed to estimate exposure as part of science-based (eco)toxicological acute and chronic risk assessments. International food trade, registrations of pesticides and veterinary drugs, academic research, and several other applications depend on the availability of high quality analytical methods that suit the purposes for the analysis.

Published in the topical collection *Food Safety Analysis* with guest editor Steven J. Lehotay.

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To meet those diverse needs, analytical capabilities have advanced tremendously compared to the earliest bio-sensing methods. This topical collection on food safety analysis covers a variety of applications in the field, consisting of many research studies and reviews about analytical developments in this always important and currently growing area of research.

Compliance with ethical standards

Disclaimer The opinions expressed in this article are the author's own and do not reflect the view of the USDA.

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Steven J. Lehotay is a Lead Scientist with the USDA Agricultural Research Service, which he joined after graduating with a PhD in Chemistry from the University of Florida in 1992. His research concerns many types of analytical techniques applied in novel and useful ways to address all aspects in the analysis of pesticides, veterinary drugs, and other contaminants in food. He is a Clarivate Analytics Highly Cited Researcher with >110 peer-reviewed publications, >220 abstracts, and >40 other scientific publications. His awards include the ACS-AGRO Award for Innovation in Chemistry of Agriculture, AOAC International Harvey W. Wiley Award, and numerous honors from the USDA.