

*This meeting recap was prepared by National Academies staff as an informal record of issues discussed during public sessions of the February 3-4, 2009 meeting of the Government-University-Industry Research Roundtable (GUIRR). The document is for information purposes only and supplements the meeting agenda available online at [www.nas.edu/quirr](http://www.nas.edu/quirr). It has not been reviewed and should not be cited or quoted, as the views expressed do not necessarily reflect the views of the National Academies or members of GUIRR.*



**Government-University-Industry Research Roundtable  
Perspectives on the 'Global Food Crisis'  
GUIRR Meeting: February 3-4, 2009**

*This meeting was intended to complement and expand upon issues presented at the October 2008 GUIRR meeting. The objective was to identify currently untapped resources within government, university and industry sectors that could provide pathways to solutions to food safety (How do we protect our food supply?) and food security (How do we feed a growing global population?) challenges if recognized and utilized via inter-sector partnerships. The issue of food safety has proved most timely, given the current focus on salmonella-tainted peanut products.*

**Meeting Summary**

Dr. Stephen Sundlof, director of the Center for Food Safety and Applied Nutrition at the U.S. Food and Drug Administration (FDA), set the stage for the meeting with his keynote dinner presentation entitled “Melamine and the History of Adulteration of Food.” He began by providing the textbook definition of “adulteration”: *the unintentional or deliberate addition of foreign substances*; then marched us through roughly two hundred years of food practices in the United States, noting that the most prominent case of food adulteration in the 19<sup>th</sup> century was known as the swill milk affair. It was Federalist Harvey Wiley who, with support from President Theodore Roosevelt, founded the Food and Drug Administration and saw passage of the first Pure Food and Drug Act in 1906.

Dinner guests were then propelled forward to the spring of 2007 when the agency first learned about melamine and its impact on household pets. Roughly 60 million containers of pet food were recalled before another alarming event hit in 2008: infants in China – upwards of 300,000 – were becoming ill due to melamine added to infant formula. As a result of the melamine scare, the FDA considers “economic fraud” an increasingly serious food safety concern. To wit:

- The pricing of foods is based on protein content.
- Protein content, we learned, is measured by nitrogen levels.
- Two-thirds of melamine is nitrogen.
- Melamine, it appears, was used in infant formula in China as a means to artificially elevate protein content.

The melamine incident has led to a number of important food safety messages. One immediate conclusion: the food industry needs to look beyond nitrogen as the sole measure of protein content. A second message is more a reminder that compounds in combination can have deleterious effect (melamine becomes markedly more toxic when combined with cyanuric acid). Thirdly, the adulteration of food for economic gain is a real concern. The overarching message, however, is both simple and profound: Global connections make safeguarding the nation’s food supply more complex.

The meeting opened the following morning with a look at supply chain issues. Robert Standaert, staff scientist with the biological and nanoscale systems group at Oak Ridge National Laboratory began by commenting on the great R&D resources at the national labs and noted that there are talented people –

especially microbiologists but also sensing/imaging experts and others – that could be readily “repurposed” for the challenges associated with securing our food supply. The same may be said for out-of-the-box research that could have applications in the food safety arena. The challenges have parallels; the national lab complex under the Department of Energy confronts many of the same problems but in slightly different incarnations. Three grand challenges in food safety were identified where full government-university-industry engagement is needed:

1. In determining how to pick a bacterium out of a complex matrix
2. In direct analysis of small molecules in a complex matrix to sample foods (surface sampling)
3. In developing non-metallic object detection – akin to explosive detection for the military (most food inspection is currently done via x-ray; a broader array of inspection techniques is needed)

Howard-Yana Shapiro, global director of plant science and external research for Mars Incorporated, followed by presenting a case study of government-university-industry (G-U-I) relations in West Africa, focusing particularly on cocoa, the sixth largest traded commodity in the world. There is no food security in places like West Africa, he said, pointing to the fragility of crops, problems of production, poor soils, declining infrastructure (e.g., roads), limited resources, and other challenges. Recognizing that problems of food safety and security – like other problems of global scale and interconnectedness – are too big to tackle alone, the Mars company has built a “coalition of equals” with IBM and USDA-ARS to sequence and analyze the entire, albeit tiny, cocoa genome. Launched in June of 2008, the project is designed to develop cocoa trees that fight drought, disease and poor harvest. Results will be placed in the public domain. One important observation: Too few U.S. research dollars go toward foods that Americans don’t typically eat, such as plantains, yams, and cassava – even though these crops serve as food staple and economic mainstay for many developing-world populations.

Mars global director of scientific affairs Catherine Woteki spoke further of the challenges of melamine in her talk, “Melamine: A Lesson in Preventing What You Don’t Expect”. A multinational food, confectionary, and pet care company, Mars was involved in the mystery early on, working aggressively to understand and respond to the issues and only later realizing, as others did, that “protein boosting” is a more widespread problem. Food suppliers, distributors, consumers, and regulators will need to “think like the bad guys” (an economic adulterant, for example) when trying to anticipate the next food-related crisis. As for what is needed from the G-U-I sectors, she advocated better intelligence about agricultural practices – particularly in countries where so many of our ingredients are sourced – and a “front-gate” mechanism by which we can effectively test foods along the entire supply chain.

Our next presenter spoke about hidden opportunities in the advanced technology sector of government and universities that can speed development of solutions in food safety. John Carney, president of a consulting company in his name, reiterated comments of others; namely, that there is a lot of technology that has been developed for one set of purposes that can have derivative benefit in other areas. In a presentation entitled “Food Safety: A Sense-Able Approach”, he demonstrated how we can effectively leverage nature – for example, our sense of smell, vision, taste, and touch – as a means to detect the unknowable threat.

Complementing this talk was a presentation by IBM research scientist Mary Helander, who spoke of opportunities within the advanced technology sector of industry that can help solve problems in food safety and security. Three specific opportunities were highlighted:

1. Supply chain management – *Diversity of the trade partner network makes solving a traceability problem with food especially difficult; thus, we need “front-gate” technologies, as stated earlier, to collect and store data that will help us to manage and solve problems in food safety.*
2. Advanced analytics – *Data mining, predictive modeling, and risk analysis can help us to see patterns as they unfold; information and characterization can be used to predict, avoid and eliminate food problems, moving us from a reactive to a proactive/preventative space.*
3. IT infrastructure – *A federated database is an example of a technology approach that may be useful in the face of disparate data sources and the possible sharing challenges across a complex network of supply chain trading partners.*

Adding to the global perspective, we heard from Antonio Ortiz-Mena with the Embassy of Mexico who presented some of the bi-national challenges associated with food and food safety. Mexico and the U.S. enjoy a strong and mature agricultural relationship; indeed, much of our food is sourced from both Mexico and Canada. Yet a food scare can create economic havoc across borders, underscoring the need for a food

security and prosperity partnership that includes: trust, permanent engagement, improved information and communication, sufficient funds to undertake research in the food safety area and deploy inspectors on the ground, and avoidance in linking legitimate food safety concerns to trade issues.

Formal presentations were capped with an engaging luncheon address by Robert Buchanan, professor and director of the Center for Food Safety and Security Systems at the University of Maryland, who spoke of the need for advanced technologies to make food protection in a global marketplace simple. The core message: We need a systems-based approach that encompasses translational research/dual-use technologies and a reconciliation of different standards.

In a concluding Q&A session hosted by GUIRR member Harold Schmitz (Mars, Inc.), it became clear that a *consortium* of some kind is needed, much like in the semiconductor industry, to address issues in food safety and food security. In addressing concerns, funding remains an issue; our current funding model for research and education does not match the needs or the opportunities. A number of GUIRR members intend to examine these issues further. If you would like to participate in the dialogue, please notify Susan Sloan, Director, GUIRR ([ssloan@nas.edu](mailto:ssloan@nas.edu)).