Scientists Working to Keep Foods Safe

Salmonella bacteria, shown here in a petri dish, are a major cause of foodborne illnesses. Scientist Marc Allard uses a genome sequencing machine being tested for field applications to rapidly identify the genetic makeup of disease-causing bacteria. For more photos of scientists at work in FDA's Center for Food Safety and Applied Nutrition, visit *www.flickr.com/photos/FDAphotos*.

The Food and Drug Administration (FDA) is using science to prevent foodborne illnesses and to respond rapidly when outbreaks occur.

This alliance of food safety and science has been forged by two powerful forces.

- The Food Safety Modernization Act (FSMA) gave FDA a mandate to implement a system that emphasizes prevention and prioritizes food safety challenges based on the risk they present to public health.
- FDA's Strategic Plan for Regulatory Science is an ongoing initiative in which food safety is a priority. Regulatory science involves the tools and methods that FDA uses to evaluate whether products are effective and safe.

"Research at FDA links the strategic goals of FSMA and regulatory science. First and foremost, we want to prevent the introduction of bacterial and chemical contaminants in foods before they enter the marketplace," says David White, M.S., Ph.D., acting chief science officer at FDA's Office of Foods and Veterinary Medicine (FVM). "And we want to provide the scientific foundation for regulations that will lead to a safer food supply."

"At the same time, we need to have the tools necessary to rapidly identify contaminants—in particular bacteria like Salmonella, Listeria and E. coli—when they do infiltrate food and to find their source before more people get sick," White says.

Hundreds of FDA scientists are at the forefront of this multifaceted research in the science of food safety.

Tracking Down Bacteria

Here is a sampling of the research being done at FDA's Center for Food Safety and Applied Nutrition (CFSAN):

- Marc Allard, Ph.D., heads the laboratory of comparative genomics, where work is done on the genetic sequencing of bacteria. (Genetic sequences are the ordered chemical

building blocks of DNA.) Allard's team has been instrumental—since the lab opened in 2009—in developing the genetic sequences that will be part of FDA's contribution to the 100K Pathogen Genome Project, the creation of a public database of the gene sequences of 100,000 bacteria that have been responsible for outbreaks of foodborne illnesses.

Allard says this bacterial research will eventually allow scientists in the United States and other countries to more rapidly identify and locate the source of microbial contaminants. This specific genetic information will also allow experts to identify these contaminants based on tests of people who have become sick.

"These bacteria are constantly evolving," says Allard. Genetic sequencing allows scientists to distinguish between strains of bacteria that might otherwise seem identical.

His team has done extensive work in determining genetic sequences of Salmonella recovered from numerous food commodities, including eggs, spices, and peanut butter as these bacteria have been associated with nationwide outbreaks of foodborne illness. They have also worked on strains of disease-causing Listeria, E. coli and Cronobacter, Allard says, adding, "A lot of food safety involves the usual suspects."

- Microbiologist Vikas Gill, M.S., is studying how best to detect Salmonella in spices, using cloves as the test subject. The first step is adding Salmonella in liquid and solid forms to mimic how these spices would most likely be contaminated. The next step is to experiment with different ways to detect Salmonella. The lessons learned from the hundreds of samples that Gill has tested can be used to develop a way to detect Salmonella in cloves. If successful, this method can potentially be applied to all other spices, Gill explains.
- One of the food-safety puzzles that CFSAN scientists are tackling is: How are tomatoes becoming infected with Salmonella and what role does the environment play in the contamination that has caused many illnesses? The scientists conducted environmental surveys from 2009 to 2011 showing a persistent Salmonella contamination in the tomato production environment, especially in surface water and sediments on and near commercial growing fields. Back in the laboratory, FDA researchers have now discovered that Salmonella-tainted soil and blossoms have lead to contamination within tomatoes and tomato plants, not just on the surface.

In Other Labs and in the Field

- FDA's Center for Veterinary Medicine (CVM) is researching the rapid detection of pathogens such as Salmonella in pet foods, pet treats and other animal foods and feeds. Scientists at CVM, in collaboration with colleagues at CFSAN, are working with a novel kind of molecular detection that has promise as a fast, accurate and cost-effective method. Called loop-mediated isothermal amplification (LAMP), this scientific tool amplifies a microorganism's DNA. Being able to rapidly identify the bacteria contaminating a pet food or animal food/feed will allow FDA to respond more quickly with steps such as product recalls and strategies to reduce risk.
- Researchers at FDA's National Center for Toxicological Research continue to study BPA—used in the production of plastics and resins in food containers—because of uncertainties raised about its effect on human health.
- FDA's Office of Regulatory Affairs (ORA) operates 13 laboratories across the United States. These labs are responsible for the testing of all FDA-regulated products, including human foods and animal and pet food. Their broad range of responsibilities includes testing for contamination of foods and feeds, targeted surveillance activities, and outbreak and emergency response. ORA's research and regulatory testing contributions include the development and validation of methods that will facilitate detection of the most toxic forms of arsenic in food. The data from these analyses will help identify potential sources and levels of arsenic in food, and support initiatives to reduce human exposure.

In the Future

FDA is working to keep pace with new food technologies, the expanding array of foods in the marketplace, and emerging hazards, such as new pathogens (disease-causing bacteria) and chemical contaminants.

One of the priorities in FDA's work on food safety is studying nanotechnology applications. This emerging field involving the use of materials so small that they can't be seen with a regular microscope is the focus of research at FDA, including at the new Nanotechnology Core Center located at NCTR. The safety of food products made with nanomaterials (including packaging) is among the areas of research.

"The domestic and international food industries are changing at a rapid pace with new technologies," says White. "And we must be nimble enough and have the appropriate expertise and resources to develop new tools, standards, and approaches to assess the safety of these innovative approaches." FDA

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