FORUM

A Food Safety Net Based on Science

ARS research is often associated with products that consumers can eat, grow, or even wear. Think of prepackaged fresh apple slices for snacking; a hardy, disease-tough daylily for planting; or a technology that improves the comfort of cotton jeans.

But sometimes, consumer benefit from the agency's scientific efforts is less visible in the marketplace because the work is largely done behind the scenes. A perfect example is ARS's longstanding commitment to helping ensure the safety of America's food supply.

As a critical member of the nation's food safety team, ARS conducts scientific studies that support regulatory agencies, including the USDA's Food Safety and Inspection Service, the Food and Drug Administration (FDA), and the U.S. Environmental Protection Agency. Research also aids farmers, animal producers, food processors, and others who must adhere to regulations, food safety standards, and laws.

ARS scientists develop technologies needed for responding to ever-changing food safety regulatory concerns, including potential breaches to our food security. But ARS also addresses issues to make sure that the foods Americans eat are safe and of the highest quality.

It's the "usual suspects"—widely occurring microbes like *Salmonella*, *Listeria, Campylobacter,* and *Escherichia coli*—which can lurk on food surfaces and ruin anyone's picnic. Without intervention, these food invaders are capable of causing diarrhea, vomiting, and other long-term food-poisoning effects. Because of their insidious nature and ability to evolve and sidestep control measures, food-contaminating microbes are constant targets of ARS scientists across the country.

For instance, in Wyndmoor, Pennsylvania, scientists at the Eastern Regional Research Center (ERRC) are focused on new ways to eliminate or reduce the incidence of food pathogens. As highlighted on pages 4 and 5, they're developing high-tech tools—based on technologies such as radio waves and ultraviolet light—for killing troubling microbes.

ARS scientists are also peering into genes of serious food pathogens, like *Listeria monocytogenes,* in hopes of gaining clues about their virulence, adaptive physiology, and persistence.

As you'll read on page 17, ERRC researchers have sequenced several *Listeria* serotypes that have been linked to foodborne listeriosis outbreaks. These investigations are important steps in developing intervention methods for preventing contamination by *Listeria* bacteria.

But one food safety concern that doesn't register in the minds of most consumers is mycotoxins. These are the metabolic byproducts of fungi that can attack a range of crops, including corn, peanuts, almonds, walnuts, pistachios, and cottonseed.

Mycotoxins may be highly carcinogenic and have been linked to liver cancer and birth defects. To protect consumers, the FDA maintains a stringent 20-parts-per-billion limit on mycotoxins occurring on vulnerable crops.

Unfortunately, consumers in the developing world—where food and feed crops are often under fungal attack—are especially at risk. In 2004, more than 125 Kenyans died because their staple corn crop was contaminated with a virulent strain of toxin-producing *Aspergillus*. And in January 2006, a large number of American pet owners learned that their dogs had suddenly died because the animals' pet food had been made with grains contaminated with aflatoxin.

Even though such incidents are rare, ARS researchers are standing by, ready to assist the U.S. regulatory agencies that monitor mycotoxins. Our scientists also want to assist in reducing the burden on farmers whose crops must be rejected—or considerably downgraded in value—when found tainted with even a small amount of fungal toxins.

As the story beginning on page 6 points out, researchers at the Southern Regional Research Center (SRRC) in New Orleans have made great strides toward unraveling the genes of one of the worst fungal perpetrators: *A. flavus*. These scientists are joining others around the globe to understand why some *Aspergillus* molds are toxic and others essentially benign. In fact, SRRC researchers recently helped sequence the *A. flavus* and *A. oryzae* genomes—deconstructing all of the genetic material belonging to these two closely related but disparate organisms. While *A. flavus* is one of the chief culprits behind devastating crop loss and contamination in the United States, *A. oryzae* is a beneficial food-grade fungus used in the production of soy sauce.

The differences in these two molds' genetic makeup should offer crucial insights into why some *Aspergillus* species are such efficient toxin producers—while others, puzzlingly, are not.

With these genomic studies as a guide, New Orleans scientists are collaborating with other ARS scientists in Albany, California, to determine how natural antioxidative phenolic compounds from host plants, such as gallic acid, can prevent accumulation of aflatoxin in economically important crops. See page 9 for more on this novel approach.

In sum, ARS's extensive research into food safety issues both before and after harvest should give Americans even greater confidence in their food supply.

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