SEEKING SAFER FOODS

HOW NCTR AND DR. STEVEN FOLEY HELP PROTECT $1.4T FOOD INDUSTRY

While serving as a summer intern at a local hospital, Dr. Steven Foley was met with an unexpected event that would help him realize what he wanted to do with his career.

Out of the blue, an acquaintance walked through the main entrance of the hospital with untied shoes, a disheveled appearance and a troubled expression on his face. Foley discovered that his acquaintance's son had come down with a foodborne infection caused by the bacteria E. coli and was being admitted to the hospital. Foley soon learned that the son would endure a long and difficult summer suffering from severe stomach cramps, diarrhea and vomiting. He would receive multiple surgeries and spend extensive time in the hospital.

"I got to know the struggle the family went through during that time," reflected Foley, now a Ph.D. of Molecular Biology and Infectious Diseases and an Arkansas Research Alliance Fellow and a member of the ARA Academy of Scholars and Fellows. "What they went through really had an impact on me. Later, as an undergraduate in college, there was a golden opportunity to enroll in a pathogenic microbiology course to study disease-causing bacteria, and I took it."

From there, Foley embarked on a mission to better understand foodborne infections and study ways to mitigate the damage that bacteria like listeria monocytogenes, E. coli and Salmonella inflict on our everyday lives. This curiosity found an outlet with the U.S. Food and Drug Administration's (FDA) National Center for Toxicological Research (NCTR) in Jefferson County, where he currently serves as acting director for the Division of Microbiology.

"The resources of the FDA enable us to explore why our bodies resist certain microbes in food and how to make the nation's food system healthier for everyone," Foley explained. "These resources include extensive expertise by collaborators both within NCTR and more broadly within the agency. This has allowed me to develop research plans and conduct research that is important to solving significant public health challenges, such as combating pathogenic bacteria."

For Foley, homing in on the source and transmission pathways of Salmonella outbreaks is a pressing public health objective. The Centers for Disease Control and Prevention (CDC) estimates Salmonella bacteria cause about 1.35 million infections, 26,500 hospitalizations and 420 deaths in the United States every year. The U.S. Department of Agriculture (USDA) Economic Research Service estimates that Salmonella infections cost the nation about $2.65 billion per year in medical bills, time lost from work, premature deaths and other costs.

Many U.S. outbreaks of salmonellosis have been associated with raw and processed foods. This is particularly concerning for public health in Arkansas, a key leader in many areas of food production and processing. According to the Arkansas Economic Development Commission and the Arkansas Farm Bureau, agriculture contributes nearly $16 billion to the economy throughout the state of Arkansas, with approximately 100,000 people employed in the agriculture and food industries. These economic drivers support billions of dollars of additional economic activity and nearly 100,000 additional ancillary jobs. Foley's collaborative research not only supports FDA's public health mission, but he also works with other researchers in Arkansas and in other areas of the federal government to implement research that directly supports the wellbeing of this essential economic engine.

"Our team is developing approaches that utilize tools available to the agricultural and public health communities, such as whole genome sequencing, that can be used to track foodborne outbreaks and conduct risk assessments. This allows industry and public health officials to make informed decisions that benefit consumers," Foley said. "These efforts help us understand the risks associated with Salmonella and how they disseminate in the food environments. One of the goals is to develop strategies to limit antimicrobial resistance and disease burden."

Specifically, Foley and his team are developing a database of Salmonella virulence genes that can be used by FDA and other public-health organizations to detect an increase in Salmonella's disease-causing ability. This allows improved utility of the gold-standard, whole-genome sequencing, for dissecting foodborne outbreaks and understanding risk. Salmonella has several different strains with variable gene profiles that allow some to better colonize the intestinal tract or evade the immune response to become more potent human pathogens that can cause severe sickness. Other genes can allow Salmonella to colonize in different environments and lead to the potential for increased spread. These different genes will be evaluated with the database and analysis tool developed by Foley and his team.

This contribution by Foley of determining the presence or absence of specific genes in a particular Salmonella will provide support to FDA and other public-health organizations in their mission-critical effort to home in rapidly and accurately on the potential source of an outbreak.

"The quicker you can pinpoint the source of an outbreak, the better you can contain the impact of the damage and investigate why it happened in hopes of preventing it from happening again," Foley said. "It's a good example of just how important the work of NCTR is to the nation and the state of Arkansas. I'm proud to be part of it."

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