Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

How ARS Does It:
Prioritizing Animal, Human, Plant, and Environmental Health

ARS research informs and provides solutions to improve the U.S. biodefense response, which is a cross-cutting issue for both agriculture and public health. USDA defines biodefense as “the prevention, detection, and response to deliberate or accidental release of biological agents that could cause harm to people, animals, or plants.” The risk of disease introduction—whether natural, intentional, or accidental—is increasing due to climate change and the increased movement of animals, plants, arthropods, and people around the globe.

These diseases are a threat to food security and to human, animal, and environmental health. U.S. biodefense as a safe and inexpensive tactic is compatible with integrated pest management approaches to ensure food security, economic, and food system resilience. The following accomplishments in 2022 highlight multidisciplinary efforts across ARS to use biodefense tactics focused on prevention, detection, response, and recovery.

Cotton textile-based sensor to detect and trap SARS-CoV-2 virus. Combatting the virus that caused the COVID-19 pandemic has been challenging for healthcare professionals and the public. ARS researchers in New Orleans, Louisiana, investigated how cotton can be used to both detect and prevent virus infections. They enhanced natural cotton peptides to resemble human cell peptides and demonstrated that the shape of the peptides influences their ability to adhere to the virus; they also found that the cotton peptide increased its ability to bind with the virus as the negative charge of the peptides increased. This finding, which helped in designing protective cotton textiles, might also be used in developing textiles to detect, trap, and neutralize viruses and designing personal protective equipment. It could also influence the development of control measures for the current and future pandemics. (NP 306)

Humans infected with Rift Valley fever could create global risks to public health and livestock. Rift Valley fever virus (RVFV) is a zoonotic virus that is transmitted by mosquitoes and causes Rift Valley fever (RVF), which primarily affects domestic ungulate livestock and humans. Outbreaks of RVF in its native range of Africa and the Arabian Peninsula cause pronounced human and animal health and economic impacts. Scientists in Gainesville, Florida, in partnership with NASA-Goddard Space Flight Center, conducted the first comprehensive review of risks that humans infected with RVFV could introduce the virus from endemic areas to non-endemic regions, and the potential spread of RVFV resulting from those introductions. This survey revealed that humans infected with RVFV and capable of infecting mosquitoes have arrived in non-endemic regions repeatedly and present a serious risk of allowing the virus to spill back into wild and domestic ungulate livestock populations, which could enable the virus to become endemic in North America, Europe, and other continents. The report generated from this survey provided detailed, tractable processes to develop monitoring systems to protect public health and livestock economies in these areas. (NP 104)

White-tailed deer are susceptible to SARS-CoV-2, but cattle, poultry, and swine are not. It is likely that the COVID-19 pandemic caused by the SARS-CoV-2 virus originated in bats and passed through an unknown animal host before its transmission to humans. At the start of the COVID-19 pandemic, ARS scientists performed emergency response, high-priority research to determine the susceptibility of various livestock species to infection with the SARS-CoV-2 virus. Their results indicated that cattle, swine, chickens, turkeys, ducks, quail, and geese were not susceptible to SARS-CoV-2. However, white-tailed deer were highly susceptible; they did not demonstrate clinical symptoms but did shed large amounts of virus in the first 5-6 days after infection, and readily transmitted the virus to other deer. APHIS Wildlife Services then initiated surveys of SARS-CoV-2 in wild white-tailed deer and found it was possible for deer to act as a reservoir for the virus and transmit it to humans. ARS scientists also demonstrated that farmed mink are susceptible to SARS-CoV-2 infection and viral shedding, despite not exhibiting symptoms. This information is critical for consumers, scientists, livestock producers, and regulatory officials who have public health responsibilities. (NP 103)

Handheld fluorescence imaging device for surface contamination detection and disinfection. Cleaning and sanitizing are important steps to help prevent the spread of illness and disease, and both are critical components of USDA and FDA Hazard Analysis Critical Control Point (HACCP) regulation and management systems for food safety. Contamination inspection is currently conducted by human inspectors via either visual examination or spot-check testing, a process that limits productivity and is prone to error. Based on an ARS patented technology, a commercial contamination, sanitization inspection and disinfection (CSI-D) handheld imaging device has been developed for identifying and preventing contamination in food preparation and serving facilities. In testing, the system achieved one hundred percent sterilization for three different selected pathogens (the fungus *Aspergillus fumigatus*, the bacterium *Streptococcus pneumonia*, and the virus Influenza A) in under 10 seconds. When implemented, the commercialized CSI-D device will help improve efficacies for FSIS and the food processing industry for HACCP contamination and sanitation inspections required under the Food and Drug Administration Food Safety and Modernization Act. (NP# 108)

Learn more about National Program 103

Learn more about National Program 301

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