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COMBATING ANTIMICROBIAL RESISTANCE

ARS research elucidates the factors associated with antimicrobial resistance (AMR) in agricultural settings and develops tools and alternatives to antibiotics that mitigate AMR for the benefit of human, animal, and ecosystem health. Antimicrobials such as antibiotics will remain an essential tool for treating animal and human diseases, though the growing prevalence of resistant bacteria has garnered global concerns over the prudent use of antibiotics in animals. The following FY 2020 accomplishments highlight ARS advances in optimizing the use of and reducing the need for antibiotics in agriculture.

Prevalence of mobile colistin resistance in U.S. animal-origin food. Colistin is a last-resort antibiotic against drug-resistant Gram-negative bacterial infections. Recently, researchers discovered a mobile colistin resistance gene, mcr-1, in clinical and animal samples. ARS researchers in Albany, California, screened more than 5,000 domestic food samples and found a very low prevalence (0.02 percent) of the mcr-1 gene in tested samples. This study was the first large-scale investigation of mobile colistin resistance in U.S. food animal products, and the information will be important for trade-related food safety risk assessments.

House flies collected in agricultural settings carry antimicrobial-resistant bacteria. Adult flies ingest and may spread bacteria during feeding and reproduction, posing risks to humans and animals in their immediate environment. ARS scientists in Manhattan, Kansas, investigated microbes carried by house flies in an agricultural setting and tested their susceptibility to 14 antimicrobials. Thirty-six of 38 microbial isolates were resistant to more than one antimicrobial, and 33 were multidrug-resistant. These results emphasize the role flies may play in harboring and disseminating AMR bacteria.

New economical and efficient strategy to remove antibiotics from wastewater. An ARS researcher in Riverside, California, and collaborators at the University of California, Riverside, designed and tested a system for removing antibiotic compounds from wastewater. The overall removal efficiencies of four tested antibiotics—amoxicillin, cefalexin, sulfadiazine, and tetracycline—were 81, 91, 51, and 98 percent, respectively. These results suggest this lab-scale proof of concept system for removing antibiotics from wastewater has the potential to be scaled up for broader use.

> **“The systems’ overall removal efficiencies for four tested antibiotics—amoxicillin, cefalexin, sulfadiazine, and tetracycline—were 81, 91, 51, and 98 percent, respectively.”**

Novel antibiotic-producing bacteria discovered on squid eggs. An ARS scientist in Peoria, Illinois, together with university collaborators, characterized several antimicrobial compounds produced by bacteria in the jelly coat of squid eggs. These antimicrobial compounds prevent overgrowth by fungi and other microorganisms on the eggs. The researchers found that multiple bacteria associated with the eggs, and chemical extracts of those bacteria, inhibited growth of the pathogenic mold *Fusarium keratoplasticum* and yeast *Candida albicans*. These compounds hold promise as alternatives to traditional antibiotics.