Multistate Research Fund
IMPACTS

# Managing Antimicrobial Resistance

In animal agriculture, antimicrobial drugs are used to protect animal health and welfare, but over the past several decades, microbial resistance to these drugs has escalated. Resistant microbes and resistant genes can spread through the environment and the food web. As antimicrobial resistance spreads, drugs may become ineffective, leaving animals and humans vulnerable to infections.

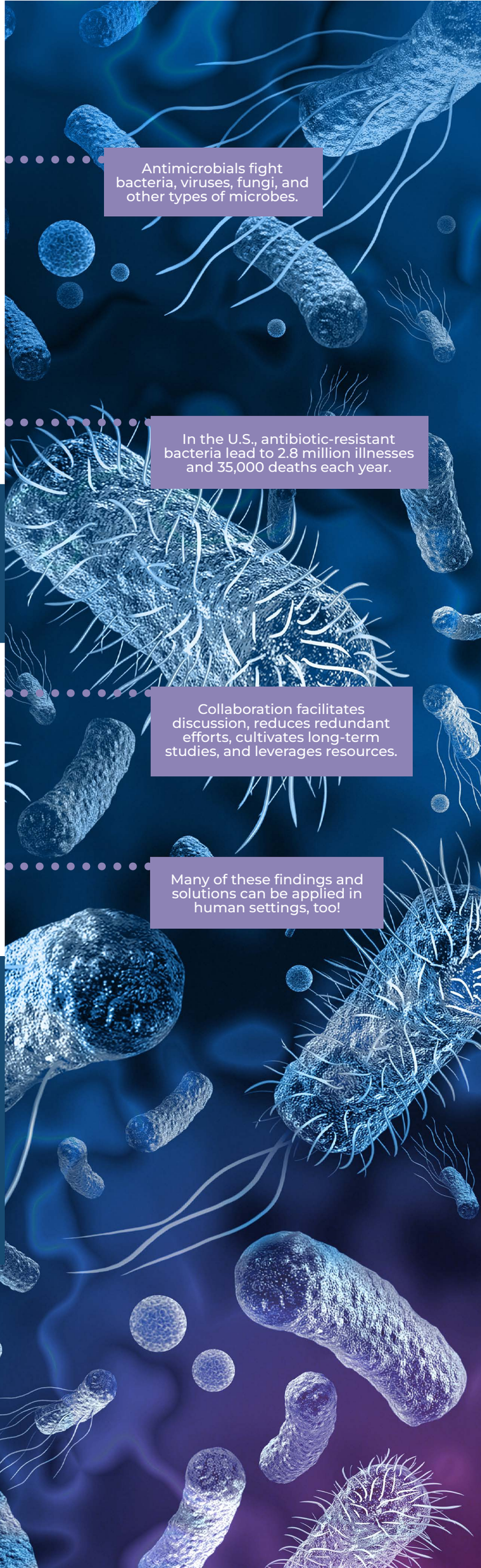
**Scientists at land-grant universities have teamed up to tackle the complex problem of antimicrobial resistance in agriculture.**

This interdisciplinary, multistate team is uniquely positioned to develop and implement comprehensive solutions as well as targeted strategies for different types of animals, environmental conditions, and management styles.

Since 2017, this team has made key discoveries about antimicrobial resistance in animal agriculture and developed ways to help mitigate it. Their outreach and education efforts have increased awareness of antimicrobial resistance issues and solutions among scientists, farmers, veterinarians, communities, policymakers, and students.

This project is supported in part by the Hatch Multistate Research Fund through the USDA National Institute of Food and Agriculture and by grants to project members at participating institutions: University of California-Davis, Cornell University, University of Illinois, Iowa State University, Kansas State University, University of Maryland, Michigan State University, University of Minnesota, University of Nebraska, University of New Hampshire, North Carolina State University, North Dakota State University, Ohio State University, Pennsylvania State University, Purdue University, University of Rhode Island, Texas A&M University, and the National Animal Disease Center.
**Learn more:** *bit.ly/MRF-NC1206*

The Multistate Research Fund Impacts Program communicates the importance and value of Hatch Multistate research projects. **Learn more:** mrfimpacts.org



# Research Highlights

**The team shed light on the characteristics and spread of antimicrobial resistant microbes and resistance genes. This information is key to estimating and minimizing risks. More specifically, researchers:**

- Evaluated how different manure treatments affect antimicrobial resistance *(Iowa, Maryland, Michigan, New York, Pennsylvania)*
- Identified poultry litter characteristics and microbiota that could exclude or reduce the growth of resistant *Salmonella (Georgia, Iowa, Kansas, Tennessee)*
- Found that moving cows treated with antibiotics to hospital pens led to higher levels of antibiotic resistance than leaving cows in their home pens *(Michigan)*
- Showed how extreme weather events like hurricanes affect pathogen distribution and movement from swine and poultry farms *(North Carolina)*
- Modeled the risk of resistant pathogens surviving antimicrobial interventions during meat processing *(Nebraska)*

**Project members developed tools for faster detection of antimicrobial resistance, which will guide judicious antimicrobial use by farmers and veterinarians. For example, scientists:**

- Improved data standardization and sharing among veterinary diagnostic laboratories, which will support faster detection of antimicrobial resistance *(Iowa, Nebraska)*
- Developed a rapid test to diagnose and recommend treatment for bovine respiratory disease *(Indiana)*

**The team developed strategies that will help reduce antimicrobial use, the development of drug resistance, and human exposure to resistant microbes. For example, researchers:**

- Identified a tomato protein with outstanding bactericidal effects on *Salmonella*, which is resistant to numerous antibiotic drugs *(New York)*
- Created new vaccines and alternatives to antimicrobials for controlling poultry respiratory diseases *(Iowa, Maryland, Ohio, South Dakota)*
- Investigated nutritional strategies to improve the intestinal health of newly weaned pigs without antimicrobial supplements *(Kansas, North Carolina)*
- Created a probiotic cocktail that enhances turkey growth and immune system function *(Delaware, Minnesota, Texas)*
- Developed heat-based technology to inactivate resistant bacteria and genes in manure *(Hawaii, Nebraska)*
- Showed that prairie strips can decrease the amount of antimicrobial resistance genes present on plots where manure is applied *(Iowa)*
- Developed models that help producers compare the cost-effectiveness of various strategies to reduce the spread of antimicrobial resistant pathogens *(Minnesota, Mississippi)*
- Developed a program that certifies farms if they provide annual reports of antimicrobial use and outcomes, helping ensure sustainable antimicrobial use on farms *(Iowa, Kansas, Nebraska)*

**Social science studies revealed perceptions about antimicrobial resistance, which will help tailor outreach. In particular, researchers:**

- Conducted a survey of farmer and veterinarian perceptions of antimicrobial resistance, in which conventional dairy farmers said they use antibiotics responsibly and further cuts would compromise animal welfare, increase costs, and raise the price of dairy products; veterinarians said they do not have the tools to treat organic dairy cows *(California, Indiana, Kansas, Maryland, New York)*
- Conducted a phone survey, which found that higher educated and younger adults perceive antibiotic use in cattle as a public health threat, are willing to pay more for milk produced by cows not given antibiotics, and support organic dairy farming *(New York)*
- Evaluated the socio-economic impact of policies designed to fight antimicrobial resistance and considered whether farmers will need compensation *(New York)*

**To improve awareness and communication about antimicrobial resistance, project members:**

- Shared findings from antimicrobial resistance studies with professionals in the food and agriculture industries and consumers via online courses, websites, experiential learning, videos, and other media *(All members)*
- Created and promoted the iAMResponsible program, which provides science-based information, resources, and decision-support tools related to antimicrobial resistance via a website, hosts workshops and lectures, and produces social media content to facilitate connections among researchers, industry personnel, and policymakers *(Iowa, Maryland, Michigan, Nebraska, New York, North Carolina, Oklahoma, Oregon)*
- Organized and taught a well-received online course, in which 24 graduate students learned from academic, industry, and government leaders about the antimicrobial resistance crisis and created scientific communication materials that were added to the iAMResponsible website *(Maryland, Minnesota, Nebraska, North Carolina, Oklahoma, Washington)*
- Participated in the National Institute of Antimicrobial Resistance Research and Education, which hosts conferences, roundtables, and webinars about antimicrobial resistance, creating community and conversation that encourages collaboration *(California, Florida, Georgia, Illinois, Iowa, Kansas, Nebraska, North Carolina, Ohio)*

## What's still needed?

Continued multistate research is needed to stay on top of emerging issues and to develop and share knowledge and tools that improve antimicrobial stewardship.