



Agricultural Antibiotic Resistance

An Environmental Component of a “One Health” approach

ANTIBIOTIC DRUGS

Which drugs are the most relevant for each type of ag production system? At what level do excreted drugs continue to provide selective pressure in the environment?.

RESISTANT BACTERIA

What is the relative contribution of specific bacteria to resistance in human clinical settings? Are some bacteria more likely than others to donate or receive resistance genes? What is the relative contribution of clonal spread of pathogens versus horizontal gene transfer?

RESISTANCE GENES

How long do specific types of genes persist in agricultural samples? What conditions increase or decrease the likelihood of a successful transfer in manure, soil, and water, and air? What is the role of the natural soil “resistome”?



MISSION

Develop practical tools and protocols to measure antibiotic drugs, resistant bacteria and resistance genes in agriculturally-impacted soil, water, air, and food; design and evaluate agricultural best management practices to limit the persistence and spread of antibiotic resistance from agroecosystems; and facilitate sharing of ideas and resources among ARS scientists by establishing an agency-wide network of researchers that have the common goal of conducting science-based research on AgAR topics.

- Connect ARS researchers at multiple locations in order to develop and assess methods for measuring resistance that are robust, and that are validated across production systems and geographical areas.
- Identify which types of resistance are relevant to measure, based on an understanding of individual production systems and prioritized human health threats as identified by WHO and CDC
- Encourage the collection of baseline data and control samples so that the impact of agricultural best management practices can be accurately determined.
- Assess persistence of antibiotic drugs, resistant bacteria and resistance genes in environmental and pre-harvest settings.



Long term goal: Discover the details of how, and at what rate bacteria and genes move back and forth between animals to humans through agricultural systems (soil, water, air wildlife, insects, and food).



Agricultural Research Service AgAR Network

Antibiotic drugs • Resistant Bacteria • Resistance Genes

ORGANIZATION

Scientists work on their own, individual research projects. The AgAR network provides resources to participants to encourage collaboration across program areas and geographical location.

MANAGEMENT

The AgAR network is operated using a wiki community approach. All participating scientists are encouraged to contribute to and share in the community resources. Currently, the group resources will be curated by the group coordinator, with input and guidance from a five person advisory panel.

RESOURCES

Bibliography of peer-reviewed AgAR papers by ARS authors • AgAR topic reference lists • information on meetings and conferences • “AR_in_environment” listserv • Community webinars

Who We Are

The AgAR network is composed of ARS scientists with an interest in understanding the ecology of antibiotic resistance in soil, water, air, insects, wildlife, and food. We currently represent 4 national programs at 10 ARS locations across the country.

The AgAR network is built on the foundation of AgAR expertise provided by current and former ARS scientists. ARS scientists already have a detailed understanding of complex food production settings, and a number of ARS researchers have been working for years on projects involving antibiotic resistance in agroecosystems. With over 200 peer-reviewed publications on AgAR topics, authored and co-authored by over 70 current and former ARS employees, ARS scientists have the knowledge and experience to tackle these tough questions.

What We Do

- Facilitate routine communication between AgAR members to address priority research areas, encourage agency and location wide collaboration and minimize research overlap.
- Establish a framework for the cross-laboratory validation of AgAR methods.
- Serve as a resource to scientists, stakeholders and administrators on current and past projects that address AgAR.
- Provide a point of contact for agency coordinators to solicit information and transmit agency goals to relevant research groups.

Why We are Needed

While there is broad agreement the use of antibiotics in food animals has the potential to adversely impact human clinical outcomes, the details of how this happens are unknown, and **there is a critical need for information on antibiotic resistance (AR) in agricultural settings (AgAR)**. U.S. and international health organizations have taken the lead on identifying specific antibiotic drugs and resistant infections that are critical to human health. ARS is uniquely positioned to provide information on the “farm” side of the “farm to fork continuum”. ARS scientists are able to address these questions in a practical way, by combining their experience (over 200 peer-reviewed ARS publications on antibiotic resistance) with their applied understanding of agricultural production systems.

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