Scientists find new way for antibiotic resistance to spread

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Washington State University researchers have found an unlikely recipe for antibiotic resistant bacteria: Mix cow dung and soil, and add urine infused with metabolized antibiotic. The urine will kill off normal *E. coli* in the dung-soil mixture. But antibiotic-resistant *E. coli* will survive in the soil to recolonize in a cow's gut through pasture, forage or bedding.

"I was surprised at how well this works, but it was not a surprise that it could be happening," says Doug Call, a molecular epidemiologist in WSU's Paul G. Allen School for Global Animal Health. Call led the research with an immunology and infectious disease Ph.D. student, Murugan Subbiah, now a post-doctoral researcher at Texas A & M. Their study appears in a recent issue of the online journal *PLOS ONE*.

While antibiotics have dramatically reduced infections in the past 70 years, their widespread and often indiscriminate use has led to the natural selection of drug-resistant microbes. People infected with the organisms have a harder time getting well, with longer hospital stays and a greater likelihood of death.

Animals are a major source of resistant bugs, receiving the bulk of antibiotics sold in the U.S.

The scientists focused on the antibiotic ceftiofur, a cephalosporin believed to be helping drive the proliferation of resistance in bacteria like Salmonella and *E. coli*. Ceftiofur has little impact on gut bacteria, says Call.

"Given that about 70 percent of the drug is excreted in the urine, this was about the only pathway through which it could exert such a large effect on bacterial populations that can reside in both the gut and the environment," he says.

Until now, conventional thinking held that antibiotic resistance is developed inside the animal, Call says.

"If our work turns out to be broadly applicable, it means that selection for resistance to important drugs like ceftiofur occurs mostly outside of the animals," he says. "This in turn means that it may be possible to develop engineered solutions to interrupt this process. In doing so we would limit the likelihood that antibiotic resistant bacteria will get back to the animals and thereby have a new approach to preserve the utility of these important drugs."

One possible solution would be to find a way to isolate and dispose of residual antibiotic after it is excreted from an animal but before it interacts with soil bacteria.

The WSU experiments were performed in labs using materials from dairy calves. Researchers must now see if the same phenomenon takes place in actual food-animal production systems.

More information: The paper, "Urine from Treated Cattle Drives Selection for Cephalosporin Resistant Escherichia coli in Soil," can be seen at www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0048919

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