Medical Xpress

Economics and evolution help scientists identify new strategy to control antibiotic resistance

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A team of scientists from the University of Oxford, U.K. have taken lessons from Adam Smith and Charles Darwin to devise a new strategy that could one day slow, possibly even prevent, the spread of drug-resistant bacteria. In a new research report published in the March 2011 issue of *GENETICS*, the scientists show that bacterial gene mutations that lead to drug resistance come at a biological cost not borne by nonresistant strains. They speculate that by altering the bacterial environment in such a way to make these costs too great to bear, drug-resistant strains would eventually be unable to compete with their nonresistant neighbors and die off.

"Bacteria have evolved resistance to every major class of antibiotics, and new antibiotics are being developed very slowly; prolonging the effectiveness of existing drugs is therefore crucial for our ability to treat infections," said Alex Hall, Ph.D., a researcher involved in the work from the Department of Zoology at the University of Oxford. "Our study shows that concepts and tools from evolutionary biology and genetics can give us a boost in this area by identifying novel ways to control the spread of resistance."

The research team measured the growth rates of resistant and susceptible Pseudomonas aeruginosa bacteria in a wide range of laboratory conditions. They found that the cost of antibiotic resistance has a cost to bacteria, and can be eliminated by adding chemical inhibitors of the

enzyme responsible for resistance to the drug. Leveling the playing field increased the ability of resistant bacteria to compete effectively against sensitive strains in the absence of antibiotics. Given that the cost of drug resistance plays an important role in preventing the spread of resistant bacteria, manipulating the cost of resistance may make it possible to prevent resistant bacteria from persisting after the conclusion of antibiotic treatment. For instance, new additives or treatments could render antibiotic resistance more costly for bacteria, making it less likely that the resistant strains will persist at the end of treatment.

"If we've learned one thing about microscopic organisms over the past century, it's that they evolve quickly, and that we can't stop the process," said Mark Johnston, Editor-in-Chief of the journal *GENETICS*. "This research turns this fact against the bacteria. This is an entirely new strategy for extending the useful life of antibiotics, and possibly for improving the potency of old ones."

More information: The Fitness Cost of Rifampicin Resistance in Pseudomonas aeruginosa Depends on Demand for RNA Polymerase, Hall et al. 2011, www.genetics.org/cgi/content/abstract/187/3/817

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