Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Bacterial cheating limits antibiotic resistance HUI XIAO CHAO, EUGENE YURTSEV, Gore Lab, Department of Physics, Massachusetts Institute of Technology, MANOSHI DATTA, Computational Systems Biology, Massachusetts Institute of Technology, TANYA ARTEMOVA, JEFF GORE, Gore Lab, Department of Physics, Massachusetts Institute of Technology — The widespread use of antibiotics has led to the evolution of resistance in bacteria. Bacteria can gain resistance to the antibiotic ampicillin by acquiring a plasmid carrying the gene beta-lactamase, which inactivates the antibiotic. This inactivation may represent a cooperative behavior, as the entire bacterial population benefits from removing the antibiotic. The cooperative nature of this growth suggests that a cheater strain—which does not contribute to breaking down the antibiotic—may be able to take advantage of cells cooperatively inactivating the antibiotic. Here we find experimentally that a "sensitive" bacterial strain lacking the plasmid conferring resistance can invade a population of resistant bacteria, even in antibiotic concentrations that should kill the sensitive strain. We observe stable coexistence between the two strains and find that a simple model successfully explains the behavior as a function of antibiotic concentration and cell density. We anticipate that our results will provide insight into the evolutionary origin of phenotypic diversity and cooperative behaviors.

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Date submitted: 09 Nov 2011 Electronic form version 1.4