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An obligatory bacterial mutualism in a multi-drug environment exhibits strong oscillatory population dynamics AROLYN CONWILL, EUGENE YURTSEV, JEFF GORE, Department of Physics, Massachusetts Institute of Technology — A common mechanism of antibiotic resistance in bacteria involves the production of an enzyme that inactivates the antibiotic. By inactivating the antibiotic, resistant cells can protect other cells in the population that would otherwise be sensitive to the drug. In a multidrug environment, an obligatory mutualism arises because populations of different strains rely on each other to breakdown antibiotics in the environment. Here, we experimentally track the population dynamics of two *E. coli* strains in the presence of two different antibiotics: ampicillin and chloramphenicol. Together the strains are able to grow in antibiotic concentrations that inhibit growth of either one of the strains alone. Although mutualisms are often thought to stabilize population dynamics, we observe strong oscillatory dynamics even when there is long-term coexistence between the two strains. We expect that our results will provide insight into the evolution of antibiotic resistance and, more generally, the evolutionary origin of phenotypic diversity, cooperation, and ecological stability.

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