

Chez Pierre

Presents ...

Friday, February 13, 2009

1:15pm

MIT Room 4-331



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“Games microbes play: The game theory behind cooperative sucrose metabolism in yeast”

The origin of cooperation is a central challenge to our understanding of evolution. Animal interactions are difficult to manipulate experimentally, thus leading to increased interest in microbial models of cooperation. In order for budding yeast to grow on sucrose the sugar must first be broken down, a reaction catalyzed just outside of the cell. Here we demonstrate that the vast majority of the resulting hydrolysis products diffuse away before they can be imported into the cell, thus making sucrose hydrolysis a cooperative behavior. In well-mixed culture a mutant cheater strain that does not break down sucrose is able to take advantage of and invade a population of wildtype cooperator cells. However, over a wide range of conditions the wildtype cooperator can also invade a population of cheater cells. At steady state we therefore observe coexistence between the two strains resulting from the fact that rare strategies outperform common strategies—the defining features of what game theorists call the snowdrift game. A simple model of the cooperative interaction incorporating nonlinear benefits explains the origin of this coexistence. Finally, in disagreement with recent theoretical predictions, we find that spatial structure aids the evolution of cooperation in our experimental snowdrift game.