HIGHLIGHTS

EVOLUTION

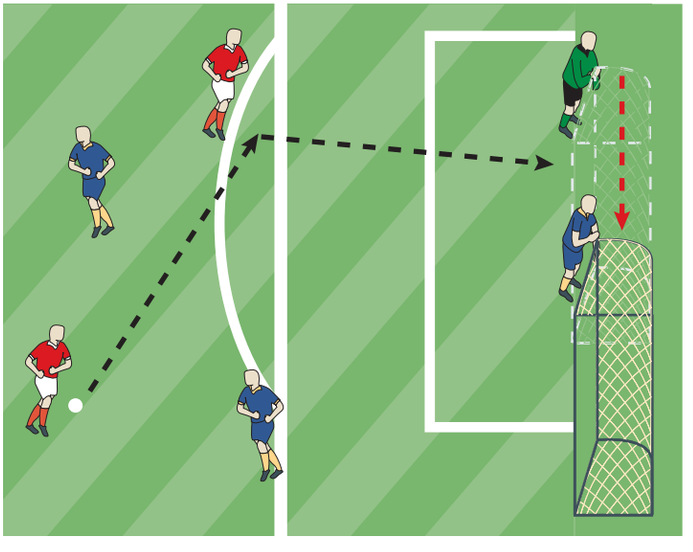
Yeast cheats can prosper

According to evolutionary theory, honesty is not always the best policy. In fact, in some social situations cheating gives the greatest advantage to individuals, albeit at the expense of the group. But can such social interactions have a direct effect on genetic variation?

Greig and Travisano investigated this possibility in yeast using the highly polymorphic *SUC* multigene family, the members of which all encode the enzyme invertase. Different yeast strains show unusually wide variation in the number of *SUC* genes that they carry and in whether or not they have a functional copy of *SUC2*.

Invertase is secreted outside the yeast cell, where it digests sucrose. This creates the potential for what has been described as the 'prisoner's dilemma' — in this case, whether individuals should cooperate and secrete the enzyme into the shared pool or defect and simply steal the sugar digested by their neighbours. Theory predicts that neither strategy is stable and their relative success varies in endless periodic or chaotic cycles. If cooperation and defection are heritable behaviours, this social instability could potentially drive molecular evolution.

To test the hypothesis experimentally, the authors created a defector strain with a deleted *suc2* gene and an otherwise isogenic cooperator strain with functional *SUC2*. The relative fitness of the two strains was measured as they competed on sucrose-rich agar. By varying the population density and thereby altering levels of social interaction, Greig and Travisano showed that the defector was less fit than the cooperator when low population density allowed fewer social interactions, but had greater fitness in more dense communities.



The polymorphism of *SUC* genes was previously thought to be caused by artificial selection in domesticated strains. However, these results indicate that selection for cheating could cause variation as a consequence of the instability of cooperation. Although the authors only examined two discrete strategies — cooperation and defection — they predict that there might be continuously variable heritable levels of enzyme production in yeast.

This elegant model shows that social interactions could have direct effects on molecular evolution, even in simple organisms. Indeed, *SUC* might not be the only yeast multigene family that has evolved to respond to unstable social pressures: similar processes might have occurred in other polymorphic families that encode extracellular proteins, such as the *MEL* genes, which are involved in melibiose catabolism. Future investigations of species with more complex social systems should provide further interesting results.

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References and links

ORIGINAL RESEARCH PAPER Greig, D. & Travisano, M. The Prisoner's Dilemma and polymorphism in yeast *SUC* genes. *Proc. R. Soc. Lond. B* (Suppl.) 10 September 2003 (10.1098/rsbl.2003.0083)