Survival of the selfless - scientists find cheats don't always prosper

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Selfishness is not necessarily the best survival trait for microorganisms, according to researchers studying the comparative effectiveness of 'cheating' and 'cooperating' strains of yeast. Writing in the journal *Nature* today, the team reports that studies of lab-grown yeast populations suggest the benefits of cheating are eventually counterbalanced by the costs. This contradicts classic evolutionary theory, which states that in a competition for common resources the long-term winner will always be the individual acting selfishly rather than the one working as part of a group.

To test this theory, scientists set up a series of competitions between two strains of yeast. The strains are identical apart from the genes that determine whether they convert energy from resources such as sugar rapidly or if they convert it efficiently.

In one corner were the 'cooperators', which produce energy efficiently by taking in sugar slowly and fully converting into energy all that they ingest. This method maximises resources available to the group by avoiding any waste.

Against them were the 'cheaters', which produce energy rapidly by quickly taking in all the sugar they can and only partially converting it into energy. While this ensures swift energy production for the individual, it is a wasteful method that reduces resources available for the group as a whole.

The researchers were surprised to find that in a well-mixed population the cooperators were not excluded by the cheats. Further experiments and mathematical modelling established that this is because cheats accumulate toxins as a direct result of taking in resources more quickly than they can digest them, which limits the level of energy they derive from the sugar. This enables the cooperators to hold their own, meaning that the two different strains could coexist over the long-term without either being excluded. Lead researcher Dr Craig MacLean of Imperial College London says:

“This evidence that a cooperative group can resist invasion by exploitative cheats is unexpected and gives us greater insight into how cooperation evolves. This is important because we live in a world in which cooperations exists at every level, from genes working together to build functioning individuals to individuals forming societies.”

The researchers suggest that the ideal organism type would be one that can switch between selfish and efficient metabolism. Dr MacLean adds:

“While microbes are obviously not capable of rational thought, they can change their behaviour rapidly in response to simple environmental cues. The possibility that one type could become both a cheater and a cooperator depending on what’s needed at the time is intriguing. We hope examining social conflict at the level of individual cells will shed more light on this.”

Source: Imperial College London