

# Amoebae control cheating by keeping it in the family

July 5 2007

---

No one likes a cheater, even a single-celled one. New research from Rice University shows how cooperative single-celled amoebae rely on family ties to keep cheaters from undermining the health of their colonies. The research appeared in the *Proceedings of the National Academy of Sciences* in May.

"It's very unusual to get a complete story in biology -- one that marries careful field work with painstaking work in the laboratory -- and that's what we have here," said research co-author Joan Strassmann, chair of Rice's Department of Ecology and Evolutionary Biology.

Rice's research involved the common soil microbe *Dictyostelium discoideum*. These amoebae can be loners in times of plenty, but when food is scarce they work together, forming colonies to ensure their survival. About one fifth of the individuals in a colony form a tall, thin stalk. The rest climb the stalk and clump together into a bulbous fruiting body that can be carried away to better environs by the wind or on the legs of passing insects.

This simple social system poses an evolutionary conundrum for biologists; the members of the stalk give themselves up altruistically to support the colony, so what's to keep more selfish strains of *D. discoideum* from cheating the system, avoiding the stalk and out-reproducing their altruistic neighbors"

Strassmann and Rice evolutionary biologist David Queller have

previously investigated how Dictyostelium colonies control cheating. For example, a study on *D. discoideum* showed that one gene governing cooperative behavior was also tied to reproduction. In another study, mutants that were genetically predisposed to avoid altruistic service in the stalk were also excluded from reproducing. A third study demonstrated that *Dictyostelium purpureum* preferentially associated with its own kin -- another mechanism that ensures altruism isn't taken advantage of by cheaters.

The current study combined graduate student Owen Gilbert's careful field and lab work on natural *D. discoideum* clones with exacting studies of genetically engineered mutant strains conducted by former postdoctoral researcher Kevin Foster and postdoctoral researcher Natasha Mehdiabadi.

"This work required investigators skilled in both field biology and molecular biology, an all-too-rare combination," Strassmann said.

Gilbert collected 144 *D. discoideum* fruiting bodies -- some of which were the first ever reported in the wild -- from 2003 to 2005 at the University of Virginia's Mountain Lake Biological Station in the Appalachian Mountains of southwestern Virginia. Back in the lab, Gilbert broke open the fruiting bodies and deciphered the genetic makeup of more than 3,000 individual spores. Though he found genetic differences between fruiting bodies, the spores within particular fruiting bodies were highly related.

Foster and Mehdiabadi worked with a mutant form of *D. discoideum* called "cheater A" that was missing a single gene known to play roles in both group productivity and reproduction. On their own, cheater A mutants produced few or no spores, but in mixed colonies they could thrive by cheating and avoiding service in the stalk. Foster and Mehdiabadi found cheater A spread readily within low-related colonies,

and exacted a high toll by reducing the colonies' ability to reproduce. In colonies with highly related cells, the cheater's individual advantages were outweighed by the overall health of the group, so the cheaters couldn't gain a foothold.

"The combination of these two studies confirms something that's been long predicted by kin selection theory -- a mutant that cheats when relatedness is low cannot and has not spread in the wild because of natural relatedness," Queller said.

Gilbert said, "Our results answer the big question of why altruism persists. It persists because high relatedness prevents the spread of socially destructive mutants."

Source: Rice University

Citation: Amoebae control cheating by keeping it in the family (2007, July 5) retrieved 9 April 2024 from <https://phys.org/news/2007-07-amoebae-family.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--