A Dicty mystery solved: Researchers find first to starve in slime mold thrive at others' expense

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(PhysOrg.com) -- The title sounds like a crime novel on a dime-store shelf. But "An Invitation to Die" is quite literal in its meaning. And the prime suspect is very, very small.

Rice University evolutionary biologists reported in a paper published today that the first cells to starve in a slime mold seem to have an advantage that not only helps them survive to reproduce, but also pushes those that keep on eating into sacrificing themselves for the common good.

The paper by Rice graduate student Jennie Kuzdzal-Fick and her mentors, David Queller and Joan Strassmann, Rice's Harry C. and Olga K. Wiess Professors of Ecology and Evolutionary Biology, appears in the online edition of the Royal Society journal *Biology Letters*. The paper's full title is "An Invitation to Die: Initiators of Sociality in a Social Amoeba Become Selfish Spores."

It helps to understand what Dictyostelium discoideum are, and how they behave. The single-cell organisms collectively known as slime mold live independently and feed on bacteria - until the food runs out. When that happens, adjacent cells aggregate into a single slug and move as a slime-coated unit toward heat and light, which indicate the presence of a good place to form a fruiting body. At their destination, amoebas at the front sacrifice themselves, dying to form a cellulose stalk. Others in the colony

climb aboard and become spores that sit on top, where small organisms disperse them to nutrient-rich places.

Common wisdom dictates that the first cells to starve would be the first to die. "Because they initiate aggregation into the social stage, we were interested in finding out what their reproductive fate was," Kuzdzal-Fick said. "For a lot of reasons, it would make more sense if the first cells to starve altruistically formed the stalk."

But that's not how it happens, and it took her months of detective work to track down the clues. Kuzdzal-Fick employed a complex sequence of raising, selectively starving and recombining clones of D. discoideum so that pre-starved cells could be tracked.

When the organisms were allowed to form fruiting bodies of stalks and spores, fluorescent tags revealed that pre-starved cells made up a much higher percentage of the spores than expected.

"They ought to be weaker than the other cells," Queller said. "They're starving first. But when they're under development, they turn on whole sets of genes that do all the things they need to do in development, and among those genes are probably ones for offense and defense. They're deploying the tools to obtain their preferred outcome -- which is to be in the spores -- before the other guys are doing it."

"You could view them like an army, where one side is still polishing its weapons, but the other side has seen them and is putting bullets in their guns," Strassmann said. "Even though they may be hungry and have worse weapons, they see the enemy and they're turning on those weapons."

Strassmann said Kuzdzal-Fick has a way with single-cell beings. "This experiment turned out to be technically very difficult, and anyone else

would have had a hard time completing this study. She's just a wizard at getting these things to behave," Strassmann said of her graduate student, who also worked in the Strassmann-Queller lab as an undergraduate at Rice. Kuzdzal-Fick expects to defend her thesis in the fall.

"Our best students really pay attention to their cells," Strassmann said. "They listen to their organisms. They know if their cells are happy, they know if they're not.

"If you have a sick lion or zebra, or even a sick mouse or wasp or fly, they look droopy and you can see it. You have to develop that exact same sense for a single-celled organism you can see only through the microscope."

More information: Read the abstract at: rsbl.royalsocietypublishing.or… l.2010.0257.abstract

Provided by Rice University

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