SCIENCE AT THE EDGE

2017 SEMINAR SERIES

Quantitative Biology Graduate Program | Gene Expression in Development and Disease

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"The Survival of the Most Cooperative: Insights from Biological and Mathematical Systems"

Cooperation, the act of providing a benefit to others at a cost to oneself, is wide-spread and has been thought to drive the major transitions in evolution. However, cooperation is vulnerable to "cheaters" who gain an advantage over cooperators by consuming benefits without paying a cost. How have extant cooperative systems survived cheaters? We have engineered a cooperating-cheating yeast system. In this system, cooperators and their cooperative partners exchange distinct essential metabolites. Cheaters exploit partner-produced metabolites without reciprocating, and are competitively superior to cooperators. Because this system is engineered, it lacks biotic mechanisms known to protect cooperators from cheaters. Using this experimental system and mathematical models, we have delineated two mechanisms that stabilize cooperation against cheating: adaptation to environmental stresses and spatial self-organization. These mechanisms can presumably "buy" cooperators time to eventually evolve sophisticated cheater-recognition mechanisms.

REFERENCES:
R Axelrod & WD Hamilton. The evolution of cooperation. *Science* 27 Mar 1981: Vol. 211, Issue 4489, pp. 1390-1396
http://science.sciencemag.org/content/211/4489/1390

Waite AJ, Shou W. 2012. Adaptation to a new environment allows cooperators to purge cheaters stochastically. Proceedings of the National Academy of Sciences, 109: 19079-19086. http://www.pnas.org/content/109/47/19079.abstract

Momeni B, Waite AJ, Shou W. 2013. Spatial self-organization favors heterotypic cooperation over cheating. eLife, 2: e00960. http://elifesciences.org/content/2/e00960

FRIDAY, APRIL 7, 2017

11:30 AM, ROOM 1400 BPS

Refreshments at 11:15

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