Rapid evolution of altruistic cooperation among multicellular proto-organisms. J. G. Gulli[1] and W. C. Ratcliff[1], [1]Department of Biological Sciences, Georgia Institute of Technology, Atlanta, GA USA

Introduction:

Cooperation is a classical solution to hostile environments that limit individual survival. In extreme cases this may lead to the evolution of new types of biological individual (e.g., eusocial super-organisms). We examined the potential for inter-individual cooperation to evolve via experimental evolution, challenging nascent multicellular ‘snowflake yeast’ with an environment in which solitary multicellular clusters perish.

Results and Discussion:

Rather than reverting to unicellularity, snowflake yeast evolved to form cooperative groups composed of thousands of multicellular clusters that typically survive selection. Group formation was driven by the production of protein aggregates, and was extremely costly, requiring up to 10% of the cells in the snowflake yeast to commit suicide. Nonetheless, it was adaptive and repeatable. Multi-cluster filaments act as a public good, and are unable to discriminate against cheats that do not contribute to filament production, though they do exclude unicellular competitors. These results underscore the remarkable fluidity with which natural selection may create and act upon new levels of selection, reaffirming the key role of cooperation as a solution to environmental stress.

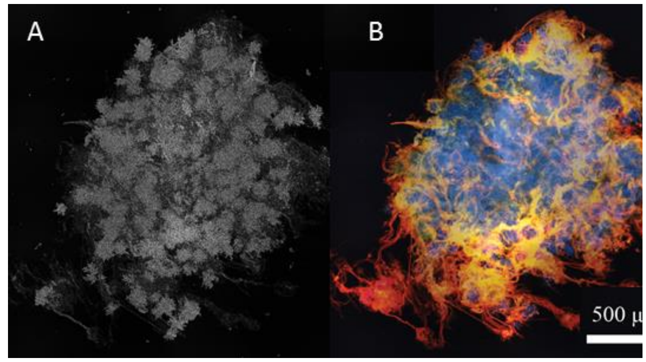

Figure 1. **Snowflake yeast filaments**. When subjected to extremely fast settling selection, snowflake yeast evolved to form a cooperative filament composed of hundreds of yeast clusters (A). These filaments contain DNA (red; Propidium Iodide), cells (blue, Cell Tracker Blue), and protein (green, Qubit probe; B).

References:

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