ORIGIN AND CONSEQUENCES OF FITNESS DECOUPLING DURING THE EVOLUTIONARY TRANSITION TO MULTICELLULARITY. P. L. Conlin[1], J. T. Pentz[2], J. G. Gulli[3], E. Libby[4], B. Kerr[5] and W. C. Ratcliff[6], [1]University of Washington, Box 351800, Seattle, Washington 98195, USA, pconlin2@uw.edu; [2]Georgia Institute of Technology, 310 Ferst Dr., Atlanta, GA 30332, jennifer.pentz@gatech.edu; [3]Georgia Institute of Technology, 310 Ferst Dr., Atlanta, GA 30332, jgulli3@gatech.edu; [4]Santa Fe Institute, Santa Fe, NM, 87501, elibby@santafe.edu; [5]University of Washington, Box 351800, Seattle, Washington 98195, USA, kerrb@uw.edu; [6]Georgia Institute of Technology, 310 Ferst Dr., Atlanta, GA 30332, will.ratcliff@biology.gatech.edu.

During the transition to multicellularity, cells evolve from individual organisms in their own right into parts of a new higher-level organism. The process by which cells lose their evolutionary autonomy (known as 'fitness decoupling') is thought to be of critical importance in the evolution of multicellularity, but our understanding of its origins and consequences remains somewhat limited. Here, we investigate fitness decoupling using an experimental system in which simple multicellularity was evolved *de novo* in the yeast, *Saccharomyces cerevisiae*, by selecting for rapid settling through liquid media. Specifically, our goal is to understand how the refinement of multicellular function and increased cell specialization can result in the fixation of traits that improve fitness in a multicellular context, but are costly in a single cell context (a hallmark of the fitness decoupling process).

Preliminary data obtained by reverting snowflake yeast from various time points back to unicellularity suggests that the longer snowflake yeast evolve as clusters, the lower their single-celled fitness after reversion (a pattern consistent with the expectation that multicellular adaptation results in fitness decoupling). We identify two candidate fitness decoupling traits, elevated rates of apoptosis and increased cell size, and offer preliminary evidence that these traits have differential fitness effects in multicellular and unicellular backgrounds. Genetic analyses are currently underway to identify the causative genes for these putatitve decoupling traits. We propose that adaptations that result in fitness decoupling may also be important because they can act in a 'ratchet' like manner to fix a nascent multicellular lineage in a multicellular state.