

Lab Summary

In this lab, students experimentally evolve single-celled Baker's yeast into a novel multicellular organism. Using simple and safe methods, students can directly examine the evolution of multicellular clusters and the process of cluster-level adaptation as the yeast evolve as multicellular individuals. These adaptations include changes in body size, and (if fluorescent microscopes are available), the evolution of a simple form of cellular division of labor. Discussion topics include evolutionary concepts about natural selection, speciation, and the tension between cooperation and conflict, ecological concepts about the costs and benefits of increased body size, and even philosophical concepts about the nature of biological individuality (i.e. when does a cluster of cells become an individual?).

This lab is modular, containing both long and short-term experiments. In the long experiment (Lab 1), students evolve their own multicellular 'snowflake' yeast from unicellular ancestors, and also perform a divergent selection experiment aimed at examining the evolution of body size. In the short experiment (Lab #2), students examine ecologically realistic selection that may have led to the origin of multicellular organisms. This kit contains sufficient materials (excluding the rotifer predators and basic lab equipment, which must be purchased separately) to perform Lab 2.

- Lab 1: Experimental evolution of multicellularity (30 minutes per day, for 3 weeks)
- Lab 2: Predator escape: an ecologically realistic scenario for the evolutionary origins of multicellularity (four 50-minute lab sessions).

These lessons are designed to be modular, meaning that we intend for you the instructor to mix and match any of these labs and tailor them to meet the needs of your individual classroom. You will find digital copies of all works on the website (<http://www.snowflakeyeastlab.com>). Many of the reagents required for this lab (especially Lab 2) are included in this kit. Supplies that are not included are readily available from most science supply companies.

Storage Instructions

All reagents in this kit can be kept at room temperature with the exception of:

- Congo red and methylene blue labeled yeast.
- Congo red and methylene blue staining stock solutions.

Keep these frozen until the day of the lab.

These labs are still in their early stages of development, and we would greatly appreciate any feedback, especially information on what worked and what didn't in your classroom. Please contact Dr. William Ratcliff (william.ratcliff@biology.gatech.edu) with any questions or comments.