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# Lake in a Tube: a microcosm system to support Course-Based Research Experiences for Undergraduate students in Biology

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**Abstract**

Complex systems often occur at scales of time and space that make direct measurement of them difficult if not impossible. For introductory biology students, the disconnection between process and pattern can cause difficulties in their ability to make strong inferences about the natural world and thus interfere with their learning. The Lake-in-a-tube (LIAT) microcosm system was designed to allow students to create controlled, replicated experiments that test hypotheses about the ecology of lakes, which are systems that are familiar, complex, and are subject to increased human attention due to water quality concerns. Using algae density as a primary dependent variable, students can readily observe changes over short time scales and quantify algae density using a variety of methods. Currently, students use the LAIT in our Introduction to Ecology and Evolution lab program at Saint Michael's College as a model system to investigate a sub-set of possible ecological processes that affect algae density. Over the course of the semester, students investigate the impacts of abiotic (nutrient concentration, stormwater runoff) and abiotic (food-chain length) on algae and then participate in a CURE (Course-based Undergraduate Research Experience) in groups that test questions of their own choosing. As a result, students develop their expertise in all aspects of conducting authentic research which can then serve as model experience for work in upper-level courses.

**Keywords**: microcosm, ecology, lakes, algae, CURE

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