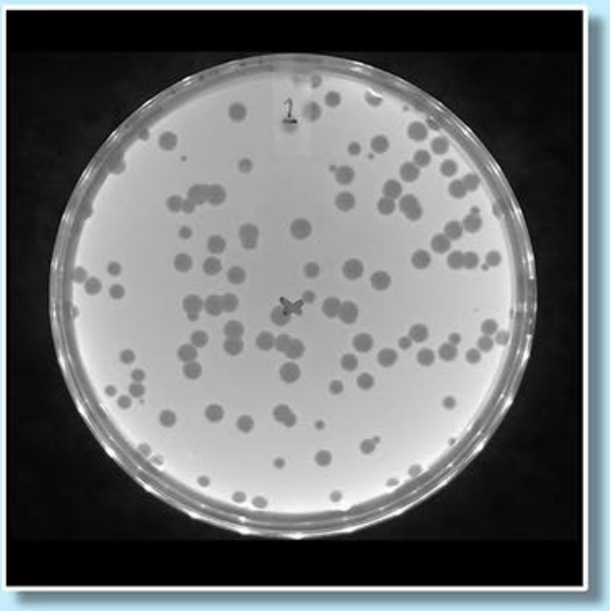
Leno Smith

Faculty Research Mentor: Dr. Christina Burch
Department of Biology



Bacteriophage plaques within a bacterial lawn

The Evolution of Phenotypic Diversification in Heterogeneous Microcosms Maintained by a Liquid-handling Robot

The survival of a population in a novel environment can depend upon the evolution of new traits—a process known as local adaption. Such adaptation to a novel environment is often presumed to occur in tandem with a reduction in fitness in the ancestral environment. However, it is not known whether performance trade-offs develop more often during evolution in the novel environment or in both the ancestral and novel environment. It was hypothesized that the likelihood of the emergence of performance trade-offs was dependent upon the ecological and evolutionary histories of the evolved populations. To investigate this premise, I performed a meta-analysis of local adaptation in published studies of experimental evolution. This literature review revealed that performance trade-offs are most likely to evolve when the environment is homogeneous rather than heterogeneous. Furthermore, in heterogeneous environments, trade-offs were more likely to develop when the environment was spatially, rather than temporally heterogeneous. The literature review demonstrated that there were too few long-term spatially heterogeneous evolution experiments, so I designed systems that can be used to conduct this type of an experiment with the bacteriophage phi-6, with the aid of a liquid-handling robot. Multi-day evolution experiments were conducted successfully with the robot, indicating potential for using the robot to perform long-term evolution experiments. Overall, these findings demonstrate that performance trade-offs do not always emerge when populations adapt to novel environments, calling into question an assumption that is frequently adopted in local adaptation studies.