BACTERIAL RESPONSE AND EVOLUTION UNDER A GRADIENT OF ENVIRONMENTAL STRESS CREATED IN A MICROFLUIDIC CELL.
L. Zhou[1,2], R. Alcalde[1,2], R. I. Mackie[1,3], I. K. O. Cann[1,3,4], B. W. Fouke[1,4,5] and C. J. Werth[1,2], [1]Carl R. Woese Institute for Genomic Biology, [2]Department of Civil, Architectural and Environmental Engineering, University of Texas at Austin, [3]Department of Animal Sciences, University of Illinois at Urbana-Champaign, [4]Department of Microbiology, University of Illinois at Urbana-Champaign, [5]Department of Geology, University of Illinois at Urbana-Champaign.

Introduction: Environmental stresses drive adaptation and evolution of life. Concentration gradients of environmental stresses exist in nature and they are potentially the key factors of microbial evolution. Further knowledge of the importance of gradients and bacterial response to stresses are critical for understanding the nature, speed and likelihood of evolution of life. It is difficult, however, for batch experiments (which are used in most prior studies) to maintain concentration gradients. To address this challenge, we employ microfluidics in our experiments to mimic natural conditions with gradients of environmental stresses. We use microfluidic gradient cells (MGC) that enable microorganisms to explore different concentrations of stressors and develop in the niches that best fit their physiology.

We use a well-known model organism, *Escherichia coli*, to assess the feasibility of using MGC to promote evolution. Fluorescence experiments are conducted to better evaluate stress response of *E. coli* to the antibiotic ciprofloxacin. Further conclusions will be drawn after use of genomic and transcriptomic techniques to track and analyze mutations in response to different stressors. We are also able to maintain three different oxygen conditions, i.e., aerobic, anoxic and anaerobic in our MGC, which suggests the MGC will support the growth of other organisms, regardless of whether they require oxygen or not. The use of different organisms will provide a broader and deeper view of the mechanisms of stress response and evolution.

The research is part of a NASA Astrobiology Institute project entitled "Towards Universal Biology: Constraints from Early and Continuing Evolutionary Dynamics of Life on Earth". Our results will allow us to evaluate the mechanisms that contribute to the evolution and development of early life.