

## **Michael Blazanin, Personal Statement**

My classmates and I were hiking up a trail in the Andes, a few hours from our Venezuelan study abroad center. As the path leveled out, I was struck by an undeniable pattern across the slopes of the opposite mountains: each altitude had its own set of characteristic plant life. As my semester progressed, I found myself reflecting on that trip and on conditions in the developing country around us. At the time, a medical supply shortage was leading to outbreaks of infectious disease. I began to recognize that the same evolutionary forces shaping alpine plant physiology also drove successful pathogens, reinforcing to me the importance and utility of understanding of how microorganisms evolve.

Two years earlier, when I entered the University of Minnesota, I could not decide which subject to pursue. I found my answer when I met an undergraduate experimentally evolving *Escherichia coli* in the laboratory of Dr. Mike Travisano. The idea of experimental evolution piqued my curiosity, and I soon began volunteering in Dr. Travisano's laboratory. Working with that same undergraduate, I designed an assay to measure how bacterial motility had evolved, then ran it for all our isolates. After investing a lot of effort, I learned to always pilot an experiment: the design had failed to control for population size, so the results were unusable. Working through the setback, I revised and ran the assay on a small scale, then retested everything, seeing success. My experience inspired me to prepare an undergraduate research grant proposal extending this project. As I wrote my application, I found myself reading the literature and synthesizing those ideas into something new with relish. I was proud of the ideas I had produced, so when I learned that it had been rejected, I was deeply disappointed. Nevertheless, my experiences had sparked an interest in biological research.

The spring of my sophomore year, I undertook a research project on plant biodiversity while abroad in Venezuela, a project which exposed me to field research. After I returned, I spent the summer working as a laboratory technician, including managing a tissue bank database. On my own initiative I began coding to manage the records. As the appeal of using computation on biological data grew, I realized I had kindled a new interest in bioinformatics. These two experiences exposed me to new scientific fields while focusing my interests to microbial ecology and evolution.

Accordingly, in my junior year, I returned to the Travisano laboratory and began a new fellowship in the laboratory of Dr. Satoshi Ishii. Dr. Ishii and I conceived of a project to measure and model the rate of denitrification, an important microbial process. This project produced large quantities of time series data. Spurred on by my nascent bioinformatics interests, I wrote several scripts to automate the analysis of this data. I enjoyed breaking the problem down computationally, and was rewarded by more efficient data analysis. At the same time, I began a project in the Travisano laboratory with bacteria and phages (bacteria-specific viruses), studying

the evolution of bacterial resistance to phage. I consulted literature, extracted procedures, and piloted them on a small scale. Enthralled by successful results, I prepared another undergraduate research grant proposal, building on the work I had done. Learning from my previous rejection, I identified an unaddressed question, crafted a precise hypothesis, and proposed experiments to explicitly test it. While I continued to work, I received the fantastic news that my research project would be funded in the spring.

As both projects continued, new complications required me to adapt. In the Ishii laboratory, improvements in precision made the protocols time-intensive, constraining my progress. Realizing the necessity of both rigor and practicality, I developed ways to run steps in parallel, spurring new advances. In the Travisano laboratory, the assays I was utilizing began providing inconsistent results. This presented a challenge, but I continued testing different protocols to improve their reliability, learning the value of persistence and never to trust that experiments will turn out as expected. Meanwhile, I was taking several courses with bioinformatics components. These classes were demanding, pushing me to improve and expand my programming skillsets. At the same time, I enjoyed the ability to find otherwise-imperceptible patterns in complex biological data. These experiences strengthened my interests in experimental microbial evolution and bioinformatic approaches.

This past summer I led a project on the evolution of bacterial cooperation as a participant in the National Science Foundation Research Experience for Undergraduates (REU) at Kansas State University. We used experimental evolution, followed by phenotypic characterization, to understand when and how cooperation persisted. This project entailed multiple lines of parallel investigation, teaching me to manage my time, so that I would never have too much or too little to do. As the summer progressed, I developed a system for tracking my ongoing work, and I was able to consistently and efficiently allocate my limited time. This fall I was able to present the results of my work at the Ecological Genomics Symposium with the support of two undergraduate travel grants.

I am now applying the lessons I have learned throughout my career as I continue my work on bacteria-phage coevolution in the Travisano lab. My experiences have led to a range of interests, centered on experimental microbial evolution. In particular, I have a strong interest in bacteria-phage coevolution. In the Department of Ecology and Evolutionary Biology, I will gain exposure to world-class scientific training and access to outstanding resources. In particular, I would be thrilled for the opportunity to work with Dr. Paul Turner, a leader in experimental bacteria-phage evolution, where I could engage in research I am passionate about while continuing to learn new techniques and skills. After receiving my Ph.D., I hope to continue a career in academic research, eventually becoming a faculty member at a research institution. As a faculty member, I intend to lead research to better understand microbial evolution, both as a model system and to inform applications for the improvement of human welfare.