Please describe your aptitude and motivation for graduate study in your area of specialization, including your preparation for this field of study, your academic plans or research interests in your chosen area of study, and your future career goals. Please be specific about why UC Berkeley would be a good intellectual fit for you.

Statement of Purpose, Michael Blazanin, Department of Integrative Biology

My classmates and I were hiking up a narrow trail in the Andes, a few hours from our study abroad center in Venezuela. As our path leveled out, I paused and surveyed the landscape. I was struck by an undeniable pattern across the slopes of the opposite mountains: each altitude had its own set of characteristic plant life. While I knew the textbook biogeography on those slopes, it failed to convey the imposing magnitude of life's diversity that I felt standing on that mountain. As my semester progressed, I found myself reflecting on that field trip and on the 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 what to study. I found my answer by surprise freshman year at an activities fair, where I encountered an undergraduate presenting his research experimentally evolving *Escherichia coli* in the laboratory of Dr. Mike Travisano. The possibility of observing evolution as it happened ousted my previous conception of evolutionary biology as solely historical. My curiosity piqued, I soon got involved. Working with that same undergraduate, I designed an assay to measure bacterial motility to show how it had evolved, then set about running it for all our isolates. After investing a lot of effort, I learned my first lesson: always pilot an experiment. Because the design failed to control for population size, the results varied wildly between replicates and 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. These experiences had ignited an interest in biological research, especially in experimental microbial ecology and evolution. I was proud of the ideas I had produced, so when I learned that it had been rejected, I was deeply disappointed. Nevertheless, I began thinking about new directions to take my research.

The spring of my sophomore year, I did research on plant biodiversity while studying abroad in Venezuela, which exposed me to science outside of a laboratory. At the same time, classes were solidifying my Spanish fluency, which I have always seen as a tool to build personal and professional connections. After I returned, I spent the summer working as a laboratory technician, managing a tissue bank database and performed molecular biology experiments. On my own initiative I began learning and writing code to manage the records, and as the appeal of using computation to analyze and understand biological data grew, I realized I had kindled a new interest in bioinformatics. These two experiences exposed me to new scientific fields, and led me to strengthen my interest in microbial ecology and evolution.

Accordingly, in my junior year, I returned to the Travisano lab, and also began a new research fellowship in the laboratory of Dr. Satoshii Ishii. Dr. Ishii and I conceived of a project to measure and model in real-time the rate of denitrification, an important microbial ecological process. This project used sensors to measure chemical concentrations over time, producing large quantities of data. Spurred by my nascent bioinformatics interests, I wrote several scripts to automate the analysis of this data. This was a new challenge for me, but I enjoyed breaking the problem down into computational tasks, and I was rewarded by more efficient analysis. At the

same time, I began a project in the Travisano laboratory with bacteria and phages (viruses which exclusively attack bacteria), studying the conditions where bacterial resistance to phage evolves. I consulted publications, extracted procedures, and piloted them on a small scale. Enthralled by successful results, I prepared another undergraduate research grant proposal, using the work I had done as a proof-of-concept. Learning from my previous rejection, I identified a gap in knowledge, crafted a hypothesis, and proposed experiments to explicitly test it. As I continued to work, I received the fantastic news that my research project would be funded in the spring.

As both the projects continued, new complications required me to adapt. In the Ishii laboratory, as I tried to improve precision, the protocols became arduously time-intensive, constraining my rate of progress. Realizing the necessity of balancing rigor with practicality, I developed ways to run steps in parallel, which improved time efficiency and spurred new advances. In the Travisano laboratory, the literature-based assays I was utilizing began providing inconsistent results. This presented a significant challenge, but I continued testing variations to improve their reliability, teaching me both never to trust that experiments will turn out as expected, and the value of persistence through such surprises. Meanwhile, I was also expanding my academic experiences, 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 process of thinking logically through an analysis and of the ability to find otherwise-invisible patterns in copious and messy biological datasets. Through these experiences my interests narrowed to experimental microbial evolution while strengthening interest in bioinformatic approaches.

This past summer I led a project on the evolution of cooperation in a bacterium as a participant in the National Science Foundation Research Experience for Undergraduates at Kansas State University. We used experimental evolution under different conditions, followed by phenotypic characterization, to understand when and how cooperation persisted. This project entailed multiple lines of parallel investigation, which required me to learn how to schedule 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 the timeline of each individual sub-project, and I was able to consistently and effectively allocate my limited time. I continue to use those time management skills today, and 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.

This fall I am 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 me to develop a strong interest in bacteria and bacteriophage coevolution, as part of a broader interest in microbial evolution. This system can reveal fundamental evolutionary dynamics of pathogen-host and predator-prey relationships, which can help inform applications to human health and biotechnology. The work of Dr. Britt Koskella investigating bacteria-phage coevolution aligns well with my own research interests. Her work has utilized both model laboratory and natural systems, and it has had an impact on my own current project. Furthermore, the academic environment of the Berkeley Integrative Biology program is outstanding, and would foster immense intellectual growth. This program would prepare me, as I intend to continue a career in academic teaching and research after receiving my PhD, with the eventual goal of becoming a faculty member at a research institution, teaching while also directed a laboratory and leading research. I envision my research being focused bacteria-phage coevolution and how we can better understand it in order to improve human welfare.

Personal History

Please describe how your personal background and experiences inform your decision to pursue a graduate degree. In this section, you may also include any relevant information on how you have overcome barriers to access higher education, evidence of how you have come to understand the barriers faced by others, evidence of your academic service to advance equitable access to higher education for women, racial minorities, and individuals from other groups that have been historically underrepresented in higher education, evidence of your research focusing on underserved populations or related issues of inequality, or evidence of your leadership among such groups.

The Personal History Statement is required for all applicants. Please note that the Personal History Statement should not duplicate the Statement of Purpose.

Personal History, Michael Blazanin, Department of Integrative Biology

When I first arrived at the University of Minnesota, I thought that someday I would likely go to graduate school. Learning, reading, taking classes – these things had always been my strengths, and so the natural extension was that someday I would go on to the highest level of learning possible. Of course, at the time I had little idea what a PhD actually consisted of, or the achievement that it denoted. As I eventually settled on the biological sciences, the nuts and bolts of what graduate school consists of became more and more clear. I learned what graduate students spend their time doing: research, reading, and writing, largely. My desire to go to graduate school was immensely strengthened as I worked on my first undergraduate research proposal. I found myself relishing the process of reading research articles, finding ideas, and tying them all together into something new. By the time I submitted that application, I was convinced: research was for me, and graduate school was my next step.

Unfortunately, the path has not always been smooth since then. While abroad in Venezuela I had an undergraduate research project to measure plant biodiversity across several ecosystems. Although I loved being out in nature, the scientific process and questions we were asking weren't exciting to me. Similarly, when I returned I worked as a student laboratory technician in a lab using rodent models and human cell culture to understand progressive disease and stress. Again, I found that, even though many of the actual methods and protocols were the same, I just wasn't engaged by the ideas. Looking back, I can see that these experiences were actually pushing me back to the research I originally became so passionate about, and that fuels my desire to go to graduate school: microbial evolution.

Once I re-focused my time on microbial evolution research, I felt that I had found my calling once again. Even though experimental progress is sometimes frustratingly slow, and there are certainly hurdles, I have embraced the life of a graduate student. For my senior year, I have dedicated more than half of my time to performing research or reading literature, and the classes I am taking are largely graduate student courses and seminars. In this, I have effectively been trying to test the life of graduate school, and I am thriving, loving the process of designing and carrying out experiments, and gaining exposure to a wide variety of scientific ideas.

Of course, not everyone is as lucky as I am to come from a privileged background. Many individuals would never be able to get to where I am because of differences in their life that prevent the choices I was so easily able to make. For several years I have been involved, first as a member, then as a chapter president, and now as an ally, with a student group on-campus working to address these challenges in elementary, middle, and high schools. Students For Education Reform (SFER) is a student-founded and student-run non-profit dedicated to challenging the status quo that leaves so many minority and disadvantaged students behind. If we are to have a successful society, and a successful scientific enterprise, it is absolutely necessary that we maintain and promote diversity. I can never claim to fully understand what it is like to come from a different place, but I have seen some of the challenges faced by others that I avoided, through SFER and through close friends, and I am determined to use my relative position of power and privilege to promote equitable access to higher education for those who have long lacked it.