As a child I enjoyed having chicken pox. I didn’t feel very sick and my younger sister caught it at the same time so we stayed home and played together. Almost two decades later while in college my sister developed viral meningitis caused by the latent chickenpox virus, and was critically ill for several weeks. I felt hopeless that I was unable to help my sister fight meningitis caused by the chickenpox virus. Anti-viral therapies are limited, and often physicians can only provide patients palliative support. Our inability to treat viral infections stems from lacking a fundamental understanding of viral physiology and the infection process. Motivated by similar to the millions who suffer from viral infections each year ranging from the common cold to chronic hepatitis, my career goal is to improve our fundamental understanding of the biochemical mechanisms of viral infections and ultimately collaborate with physicians to develop novel treatments for viral diseases. In the short-term, my goal for my PhD research is to use computational systems biology in conjunction with experimental biology to understand how viruses interact with their hosts. My long-term career goal is to use our newfound understanding of host-viral interactions to inform how we treat infections in medicine, agriculture, and industry.

My interest in host-viral interactions stems from a fascination with scientific exploration that began at a young age. I attended a Montessori elementary school where I was given great intellectual freedom and developed an ability to independently educate myself. I was constantly organizing my own field trips to local museums and designing experiments that I carried out in our small classroom. Science was fun and exciting and I loved how it always left me more curious than when I started. In high school I began to see that science could be more than just a hobby. I completed the rigorous requirements for an International Baccalaureate Degree focusing on biology, chemistry, and math. Determined to bring together my interests in one course of study, I decided to major in chemical engineering at Northwestern University. My junior year at Northwestern I became engrossed in a bioengineering lecture series featuring ongoing research by Northwestern faculty ranging from metabolic engineering to tissue engineering. I was captivated by how the researchers worked at the intersection of the disciplines of biology, engineering, medicine, and computation. Motivated by my newfound interest, I decided to pursue a certificate in Biotechnology and Biochemical Engineering which required additional coursework and undergraduate research. I chose to work with Prof. Linda Broadbelt on the computational discovery of novel biosynthetic pathways to butanol for biofuels. This was my first hands-on exposure to computational systems biology, and I enjoyed how it required an excellent grasp of the experimental biology literature with the ability to make modeling approximations. Despite taking additional coursework and conducting research, I made the Dean’s List 12 quarters, earned the highest GPA among my chemical engineering class, and received the engineering faculty's prestigious McCormick Award given to top senior engineering student. I decided to attend Stanford University for graduate school and pursue a PhD in chemical engineering under the guidance of Prof. Markus Covert in the Department of Bioengineering. My work with Prof. Covert on host-virus interactions is a perfect fit to my scientific interests in interdisciplinary engineering, biology, and computer science research.

As part of my college education I felt it was important to explore professional science and engineering opportunities beyond academia. Consequently, I obtained a cooperative education position at Applied Thin Films Inc. (ATFI). ATFI is a small, research driven start-up company which develops thin-film technologies for solar cells. At AFTI I conducted basic engineering research on thin-film technologies for solar cell and aerospace applications. For 3.5 year I alternated between school and full time employment. My supervisor, Dr. Todd Gudgel, made a distinct impression on me throughout my tenure at AFTI. Todd led by example, and taught me what it takes to be a successful engineer, scientist, and communicator. He was great at helping me work through both scientific and personal problems. During conversations about graduate school he reminded me how much I obviously enjoyed doing science, and in particular research full time. It was a huge relief to hear this from someone I trusted, and from that point I knew I wanted a graduate education and a career of scientific exploration.

I believe that scientists should be leaders, communicators, and teachers in order to create a scientifically literate population – an important requirement for both technological progress and public policy favorable to scientific and technological development. I am actively involved with enriching the broader community and have been since high school. In high school I volunteered for 10 hours every weekend at the Schlitz Audobon Nature Center near Milwaukee, Wisconsin. As a volunteer I split my time between land management projects and assisting with educational outreach programs for young children from disadvantaged Milwaukee neighborhoods.

In college I joined the Gateway Science Workshop (GSW) program. During my first two years of college I volunteered as a GSW facilitator 8 hours per week, organizing weekly problem solving workshops where students collaboratively tackled engineering problems. My junior year I volunteered 10 hours per week as a senior GSW facilitator where in addition to holding workshops, I held weekly meetings between facilitators and professors, generated new workshop problems, and set expectations for GSW facilitators.

In graduate school I joined the Stanford Science Bus program. Science Bus is an after school program which generates excitement about science among disadvantaged Bay Area elementary school students through hands-on experiments. The lesson plans I have developed and executed have transformed my students including Kendra was a bored 1st grader when I first met her, and has now become an actively engaged and excited 2nd grader who each week tells me about the experiments she did in her parent’s kitchen.

I plan to continue my involvement in education and outreach throughout graduate school: (1) I plan to continue volunteer with Stanford Science Bus and become a program coordinator beginning in Winter 2012. In this leadership position I hope to expand the Science Bus program to middle school students. (2) I have already begun to volunteer with SPLASH, a great program that enables Stanford students to teach free classes to local kids. This fall I taught a lesson titled “Biology and Biotechnology of your Vegetables” where students learned about the life cycle of plants and how biotechnology affects food. (3) I plan to mentor elementary and middle school children through the Stanford Science in Service program and the local Boys and Girls Club. Each week I plan to provide my mentee with a fun hands-on science experience.

In conclusion,I believe that the NSF graduate fellowship will help me accomplish my goal of using systems biology to change how we treat infections in medicine, agriculture, and industry. Specifically, an NSF graduate fellowship will allow me to continue to work with my advisor Prof. Markus Covert investigating the basic biological mechanisms of host-viral interactions. Furthermore, an NSF graduate fellowship will allow me to continue to introduce students like Kendra to the excitement of science through the Stanford Science Bus and SPLASH programs.