Florence Tabrys is an 84-year old grandmother from Redwood City, CA. When I met Florence at Stanford's student run Arbor Free Clinic last year, we had an engaging conversation about her grandchildren and my experiences at Stanford. Unfortunately, Florence is not the healthy 84-year old woman she appears to be. Despite being able to cook dinner for her and her husband each evening, she has difficulty with more complex tasks such as driving and paying bills. Florence, along with 15 million other elderly persons worldwide, has Alzheimer's disease, a slowly progressive and incurable disorder.

My scientific goals are two-fold: 1) to use systems biology in conjunction with traditional neurobiology to quantitatively understand and model the biochemistry of memory, and 2) later in my career to use this model to inform our understanding of memory disorders. I believe that systems biology is ideally suited to attaining these goals because systems biology provides a rigorous framework for building and systematically refining quantitative physiological models.

I first learned about systems biology in 2004 at MIT's annual Systems Biology Symposium. As luck had it, the symposium included a panel discussion with David Botstein, Leroy Hood, and Marc Kirschner entitled "Research and Education in New Biology", which enumerated the skills necessary to practice quantitative, model-driven experimental biology: solid background in physics, chemistry, mathematics, and biology; sharp experimental intuition; and, perhaps most importantly, knowledge of how to use physics and mathematics to gain unique insights into biology. Throughout college I directed my studies toward acquiring these skills and becoming a systems biology researcher. In my first three years of college I took foundational courses in physics, chemistry, mathematics, biology and neuroscience. This prepared me for advanced courses in biophysics, systems biology, and computational biology in my senior year. In parallel I spent my summers working with scientists such as Professor Michale Fee who had trained as physicists or engineers and were quantitatively addressing neurobiological problems.

After college I decided to step back from systems biology and neuroscience and enroll in the new Masters of Science in Medicine program at Stanford. My goal in participating in this program is to prepare myself for the second phase of my career during which, in addition to continuing to elucidate the biochemical basis of memory, I will collaborate with physicians to translate advances in the basic science of memory into novel treatments for memory disorders. In this way I hope to be as prepared as possible to help design new treatments for Alzheimer's disease and other memory disorders so that my generation and my childrens generation are never robbed of their memory and independence the way Florence will likely be in her last years. The Masters of Medicine program has vastly expanded my knowledge of biomedicine, and more importantly it has given me the opportunity to think about how quantitative science can be used to advance human health. The program has also enabled me to interact with clinicians, including the post-doctoral fellow in the Department of Medicine with whom I am currently collaborating to use flow cytometry and bioinformatics to map signaling networks in tumors of individual patients and predict patients' responses to treatment and prognosis based on the signaling network active in their tumor. In total, I believe that with my combined training in quantitative neurobiology and translational medicine I am uniquely prepared and eager to pursue an academic career first focused on the systems biology of memory, and later expanded to the translational medicine of memory disorders.

Beyond the research lab, I am actively involved in scientific outreach, education, and leadership development. As a freshman and sophomore, I volunteered 3 hours each Saturday to refurbish

computers for low-income families, and I tutored students in electricity and magnetism 2 hours each Thursday. Sophomore year I also served as secretary and regional representative of MIT Hillel. Junior year, I spent 5 hours each week of the spring semester designing graphics for a web-based physics tutoring program for high school students and early undergraduates. That same year I also gained invaluable leadership and management experience as president of my fraternity. This position required me to manage all aspects of the fraternity including membership recruitment and retention, external relations, building maintenance, and budgeting. During the summer between my junior and senior years, I read and recorded over 100 hours of calculus textbooks for blind and dyslexic students. Senior year of college I served as secretary of the Order of Omega Honor Society. In this capacity I created and maintained a website to disseminate information to our members. This past year I've become involved with three mentoring programs – one for low-income Bay area high school students interested in careers in science and medicine (SMYSP), another for underrepresented Bay area pre-medical students (SUMMA), and a third for pre-graduate or pre-medical Stanford undergraduates (BioBridge). Each of these programs has paired me with one high school or college student with whom I meet monthly to discuss and work toward their biomedical career goals. Currently I also organize a biophysics student journal club.

Of these experiences, by far the most meaningful and gratifying has been mentoring a high school student, Fernando Rios. Born in Jalisco, Mexico into a working class family and having immigrated to the United States only five years ago, Fernando does not have the benefit of friends and family who can serve as role models for higher education, help him apply to college, or explore biomedical career options. I met Fernando at SMYSP. Over the summer we met each Thursday evening to get to know each other and talk about Fernando's dream of becoming the first in his family to graduate from college. Since then we've worked together to achieve his goal. In particular, I've helped Fernando succeed in his AP classes and write college and scholarship application essays. Knowing that Fernando will be the first in his family to attend college in part because of my support strengthens my commitment to science outreach.

Throughout graduate school I plan to continue to mentor low-income and underrepresented high school and college students. In addition, I hope to strengthen the systems biology community at Stanford and nationally with three projects: 1) with Stanford faculty I plan to develop a project-based systems biology course in which graduate students will build quantitative models of biological systems using publicly available data, 2) I will help my research advisor Professor Markus Covert develop self-guided systems biology workbook that will teach undergraduates how to build mathematical models of biological systems, and 3) I hope to organize a biological network modeling competition to help centralize modeling efforts in the systems biology community. This competition will follow the style of the Critical Assessment of Techniques for Protein Structure Prediction (CASP); teams will compete to infer the structures of synthetic biological networks.

In conclusion, I believe that an NSF graduate fellowship will help me pursue my professional goal of easing Florence and her family's suffering by enabling me to continue to learn how to practice rigorous quantitative systems neurobiology toward becoming an academic systems neurobiologist. Specifically, an NSF graduate fellowship will enable me to continue to work with my advisor Markus Covert to build quantitative models of synaptic plasticity. Furthermore, an NSF graduate fellowship will allow me to continue my efforts to help young students such as Fernando explore careers in science and promote quantitative biology education.