My introduction to research was in the laboratory of Dr. [redacted] at the [redacted]. I studied the expression of nicotinic receptor alpha7 in the mouse adrenal gland, working full-time during the summers of 2010 and 2011. My research identified a possible role of alpha7 in adrenal development and in norepinephrine production later in life. I sectioned embryos, performed IHC and used confocal imaging to produce parts of five figures for a **manuscript that was recently published** on which I was third author ([redacted]., 2014).

During my Sophomore year, I sought out opportunities at my home institution, [redacted] There, I joined the laboratory of Dr. [redacted] where I spent three years. During my first year in the laboratory, I developed a neuronal explant protocol that was integral to a figure in a **publication** on which I was an author ([redacted]. 2011). After years of development in the laboratory, I made a critical breakthrough that allowed for the primary culture of individual olfactory sensory neurons (OSNs) directly on coverslips, **a method that did not exist for the olfactory system before this**. This allowed me to address a complex problem: how combinations of cadherins affect developing neurons. **I discovered a novel phenotype**; *protocadherin-19* (*pcdh19*) and *n-cadherin* in combination cause a significant increase in neurite outgrowth. For the first time ever *in vitro*, I demonstrated that *pcdh19* could produce any significant effect. Furthermore, this interaction suggested a specific mechanism for proper neural development. The complete ownership and independence of my honors thesis established how rewarding a career in academia could be for me.

My work highlighted the importance of studying axon guidance cues in combination, demonstrating that most studies have been insufficient to understand their role in development. I planned experiments, immersed myself in literature, performed primary culture, purified protein, imaged neurons, and performed statistical tests to prove that my results were significant. **I was awarded *magna cum laude* in Biological Sciences for my thesis, *Defining the Combinatorial Cadherin Code.*** This project also led to two poster presentations ([redacted] Honors Thesis Poster Session 2013 and Center for Vertebrate Genomics Symposium 2013) and data for a manuscript currently in preparation on which I am first author.

In addition to my extensive research experience, I was engaged and active in my community during college. [redacted] served as a patient and dedicated mentor within and beyond the laboratory, encouraging me to have an active role in education and community. My teaching experiences have ranged from serving as an ESL assistant in Italy for elementary students, to mentoring refugees, to tutoring adults in college courses (Genetics, Chemistry, Biology). I became personally invested in each of my mentee's success, staying in contact with them throughout their education. Serving as a role model was extremely rewarding and working with the students has challenged me to become an effective teacher and mentor.

In an effort to combine my interests in neuroscience and community involvement, I volunteered as a camp counselor at Camp Kostopulos, a residential camp that sponsors a two-week camp for adolescents with Neurofibromatosis (NF). I served as a supervisor to a group of six campers every day, responsible for all aspects of their camp experience, including compliance in taking their medications. I learned about NF by experiencing how this disorder

impacted their young lives. Some campers had debilitating tumors and learning disabilities. On the last day of camp, physicians and scientists came to answer questions about current trials and treatments of NF. The campers asked informed questions about preclinical trials and how the disease affected their bodies on a cellular level. Understanding the biological basis of the disease made NF less scary. I watched adolescents become capable advocates with more control over their bodies. This opportunity at NF camp complemented my involvement with Leadership Education in Neurodevelopmental and Related Disabilities (LEND). LEND has 43 interdisciplinary programs throughout the United States that work together to address national issues through the integration of services from state agencies and organizations, private providers, and communities. I have been fortunate to shadow members of LEND, as well as to attend Grand Rounds and seminars at the [redacted]. Interacting with trainees from different disciplines has allowed me to experience how people approach science from different perspectives. I saw firsthand the applications of basic science in clinical settings and knew that I wanted to act as a **scientific leader in my community.**

In my **honors fraternity** at [redacted] Phi Sigma Pi, I took on the leadership role of Scholarship Chair and promoted science education for local elementary students. I helped organize Nano Days at the Ithaca Science center, recruiting volunteers and demonstrating basic science experiments to students. During my senior year, I served as a **biology advisor** where I mentored six incoming freshmen. I advised them in their class selection and academic goals. As I had also come far from home, I provided support to many of my advisees, helping them adjust to the academic rigors of a challenging college curriculum, as well as the social adjustments. I taught my students how to create study plans and provided information regarding coursework, major requirements, and summer opportunities. I was also chosen to be an undergraduate **Teaching Assistant** for Issues in Social Biology. I loved helping students learn and become excited about a subject that most of them were previously uninterested in. I enjoyed facilitating class discussions and helping non-majors gain an understanding of basic biology.

Following graduation, I accepted a position as a laboratory technician the laboratory of Dr. [redacted]. Within the laboratory, I directly work on the project of Dr. [redacted] which focuses on developing reporter mice for calcium imaging using novel genetic approaches. My contributions of southern blots, immunohistochemistry and confocal imaging resulted in a figure for a **recently published feature article on the cover of Neuron for which I was a contributing author** ([redacted]., 2014). More recently, I have mastered various cloning techniques (Gibson cloning, recombineering, subcloning) to design reporter mice to study neuronal-glia interactions as well as vectors used for *in utero* electroporation (IUE) and viral injection. Designing plasmids has introduced me to the intricacies of molecular genetics as well as the versatility and possibilities regarding manipulation of the mouse genome. I have used the GCaMP6 series of Genetically Encoded Calcium Indicators to design another calcium reporter that will allow for direct imaging of neuronal and glial populations in living mice. These genetic tools will be extremely valuable in the monitoring of multiple cell populations within the nervous system in order to better understand neurogenesis and certain diseases, such as autism and

epilepsy. My experiences with molecular biology have prepared me to bridge genetics and neuroscience in the future.

The most exciting days in the laboratory are when all of the pieces fall into place, but I also understand the challenges involved with research. While in the [redacted] lab, I helped a PhD student design an IUE vector that uses two fluorescent proteins to differentially label neurons and astrocytes as well as GCaMP6 to monitor calcium activity in both cell types. The plasmid utilizes two promoters (one neuron specific) and cre/lox recombination. After a failed attempt to make the vector, I researched past literature and suggested the insertion of two repetitive insulator sequences flanking the second promoter in order to prevent leaky signal. Working together with postdocs, I helped her plan the series of steps required, combining Gibson Cloning, subcloning and site-directed mutagenesis. The *NASTIE* plasmid (**N**euron **A**strocyte **S**pecific labeling **T**argeted with ***I****n utero* **E**lectroporation) was recently completed utilizing my suggestion. My contributions to the *NASTIE* plasmid and the GCaMP6 mouse were recently presented on posters at multiple conferences (Gordon Epilepsy Conference 2014, Snowbird Neuroscience Conference 2014, Translational Neuroscience- NSF satellite 2014).

During my time in both the [redacted] lab and [redacted] lab, I have taught undergraduate and graduate students. The summer following graduation, I mentored two undergraduate students at [redacted] teaching them IHC, basic microscopy and helping them to understand the goals of my project. In the [redacted] laboratory, I have trained a variety of people in many techniques, including mouse perfusions, basic cloning methodology, and PCR troubleshooting. I have served as a mentor for a rotating graduate student as well as an undergraduate in a summer program. These opportunities have made me an **effective communicator and a patient teacher.**

Broader Impacts: Throughout my entire college career and time in the [redacted] lab, I have been involved in mentoring activities and K-12 outreach. From LEND, to serving as an NF camp counselor, to mentoring college freshmen, I have used my scientific background to promote scientific learning. I will continue this as a graduate student, where I have planned future LEND presentations and outreach activities.

Intellectual Merit: Over three laboratory experiences, in college and after graduation, I have made significant contributions to neuroscience research. I have been an author on a published paper in each of these labs, and have consistently demonstrated my ability to be a highly effective and productive member of the lab, contributing at both the technical and theoretical levels of research. I graduated with high honors and have consistently taken challenging courses.

Future Goals: Having participated in research projects across a spectrum of laboratories, I have learned that collaboration drives innovation in the scientific world. The NSF Fellowship enables such innovation and would give me the academic freedom to focus on my research interests at any institution. I am currently in the process of applying to graduate programs in neuroscience because of my fascination with neurogenesis and associated neurological disease. NSF funding will enable me to focus on neuroscience questions and to facilitate education for the next generation of young scientists.