The month of my 18th birthday, I correctly diagnosed myself with diabetes. I was chronically fatigued—the vaguest of symptoms—but knew of my family's history of diabetes. Using my grandfather's glucose meter, I tested my hypothesis and found that my fasting blood sugar was much higher than the non-diabetic threshold. My doctor confirmed the diagnosis as type 1 diabetes with additional antibody testing, but my life hasn't been the same since. At the beginning, the several times a day insulin injections and finger sticks were, strangely, pretty fun to me because at the time I had wanted to go to medical school. As you might be able to imagine, having to constantly poke and prod myself did eventually become tiresome and monotonous. In the end, I'm fortunate that my interest in biology and my keen observation that something might be wrong led me to discover that I am diabetic.

Ultimately, I believe my diagnosis only strengthened my interest in science. I know I am still alive today thanks to scientists like Sir Frederick Banting, Charles Best, and J.J.R. Macleod because of their discovery of insulin, and many others who have dedicated their lives to research. When I had graduated from high school, I was adamant that I go to a school with an undergraduate program in biochemistry, which Winthrop University in Rock Hill, SC had.

My plans to go to medical school changed after less than a year into undergrad. In my second semester at Winthrop, I took General Chemistry II with one of the biochemistry faculty as the instructor, Dr. Jason Hurlbert. A few weeks into class, he wrote me a note at the top of my quiz on amino acids saying, "When are you going to consider getting into lab? See me if you are interested!" My eagerness to learn the amino acids backwards and forwards had apparently impressed him, and so I started working in his lab that summer and for the remaining three years of undergrad. As a result of that experience, I fell in love with the bench and basic science research.

Relevant Experience and Intellectual Merit: The Hurlbert lab studies protein structure by x-ray crystallography, and my major research project was to clone a working expression construct for recombinant production of human sphingosine kinase 1 (SK1), a protein that is upregulated in many cancers and allows the cells to evade apoptosis despite targeted radiation and chemotherapy. For this reason, SK1 has become a novel drug target in the fight against cancer. At the time, the SK1 structure was unknown, and so the ultimate goal of my project was to determine the structure of SK1, as a model would aid in the design of inhibitors for potential therapeutic use. However, crystallography requires a large amount of purified protein, so my senior research project was to optimize the overexpression the protein.

Previous efforts to overexpress SK1 in *Escherichia coli* were unsuccessful for reasons largely unknown. I had tried several different approaches, but nothing seemed to be working. My senior year was going by quickly, and I was getting discouraged, but I was determined to make some sort of progress. One of my final efforts was to truncate the protein and remove predicted disordered regions from both termini. I also wanted to clone the gene into an expression construct that would create a maltose binding protein fusion (MBP), as I had learned that this tag could improve solubility. My hypothesis was that because SK1 is a lipid kinase, the protein could have solubility issues as it is likely to associate with the membrane, and the addition of a MBP affinity/solubility tag would improve soluble expression.

Finally, in February of my last semester, I was able to detect expression of SK1 from one of my plasmid constructs on an SDS-PAGE gel. The moment I had discovered that I was successful, I was ecstatic! That semester I presented my work at a regional undergraduate conference—Big Southern Undergraduate Research Symposium (BigSURS)—where I won first place for my biochemistry poster.

Unfortunately, three days after graduating from Winthrop, a paper with the structure of SK1 was published by researchers at Amgen, Inc. Although I was disappointed that the project was scooped, I was excited to know I was working on the same project as a company with a $4 billion annual research and development budget.

I did not apply for graduate school during my senior year at Winthrop largely for two reasons. First, I did not feel prepared to make a 4-7 year long commitment to more schooling, and was afraid that if I did I wouldn't make it to the end. Second, I had financial limitations due to a lack of health insurance and felt like I needed to start school without any debt. After graduating from Winthrop with a science GPA of 3.81 (3.44 overall), I instead chose to work in industry for two years to both gather myself and more laboratory experience.

The first company I worked for was BestCo doing quality control testing using techniques such as GC, HPLC, quantitative FTIR, and various titrimetric methods. While at BestCo, I had the opportunity to participate in method validation and development, learning how to assess accuracy, precision, specificity, and linearity of several HPLC methods. I found this experience useful later when developing assays of my own.

After 11 months at BestCo, I joined Physician's Choice Laboratory Services (PCLS) as a Genetics Technologist performing clinical pharmacogenetics testing. One of the scientists, Dr. Lusheng Xu, quickly put me to work helping develop a haptoglobin genotyping assay. My director, Dr. Qing Zhang, quickly took notice of my work and after six months began assigning me validation projects of my own. One of my first responsibilities was to validate the new high throughput microarray system our company had purchased that was to replace the TaqMan genotyping assay already in use. This proved to be a unique challenge as the microarray platform was capable to detecting 16 different genetic variants for the cytochrome P450 2D6 gene, and each had to be individually evaluated for accuracy, inter-day and inter-operator precision, and sensitivity. Following three months of hard work, I was proud to see my validation approved and the system put into use.

Two of the sixteen genetic variants for the CYP2D6 gene were for copy number—either duplication or deletion. One of the pitfalls of the test was that when an individual had both a gene duplication and a heterozygous call for a particular polymorphism, we were unable to accurately determine which allele was duplicated (i.e. haplotype phase) and therefore could not predict the patient's phenotype. I hypothesized that we could use the previously validated TaqMan assay to determine the haplotype phase based on the differences in threshold values for the wild-type and mutant alleles. In my reading, I had learned that the 1846G>A polymorphism is frequently duplicated in people of African descent whereas Caucasians rarely ever have this haplotype. Astonishingly, I found a perfect correlation between the predicted haplotype phase using the TaqMan assay and the reported race of the patient sample. Unaware of what I had been doing, I brought my data to Dr. Zhang who was very interested in doing a complete validation. At her request, I wrote a validation proposal for her to share with the Chief Scientist and Medical Director. Unfortunately, the company was hit hard by a recent Medicare and Medicaid reimbursement change and the assay was never validated.

My two years in industry gave me valuable laboratory experience, learning troubleshooting and assay development and validation. At this point, I felt I was ready to begin graduate studies, both personally and financially, and joined the laboratory of Dr. Laurie Steiner as part of the Biochemistry and Molecular Biology program at the University of Rochester.

A large part of why I joined the Steiner lab is because I felt that the diverse experiences and skills I would learn in her lab would allow me to become a well-rounded scientist. I have

found chromatin to be a fascinating structure with so many unanswered questions. I feel as though my previous experiences in structural and molecular biology have prepared me well for studying heterochromatin formation. Furthermore, as high-throughput techniques become more affordable and commonplace—like next-generation sequencing—data sets will become larger and more difficult to interpret. The Steiner lab regularly performs experiments using high throughput sequencing (e.g. ChIP-seq, RNA-seq) thus creating large datasets. I've been working closely with our bioinformatician learning how to analyze sequencing datasets, and I reformatted my old gaming laptop with Ubuntu to do my own analyses.

Broader Impacts: My undergraduate mentor encouraged me join the Council of Student Leaders my junior year of college. He explained that it is important for scientists to be involved in politics because so many policies and decisions made on Capitol Hill can directly affect research and science education. My senior year I decided to get involved in more leadership roles. I served as president of Student Affiliates to the American Chemical Society (SAACS) where we visited a local children's attention home to perform science demonstrations including freezing point depression ice cream and cornstarch slime. As president, I also arranged a tour of a local silicone manufacturing plant for chemistry majors at Winthrop. Since the tour, Bluestar Silicones has hired five Winthrop graduates. I also had the opportunity to serve on the Dean's Student Advisory Board to represent chemistry majors which included being involved in preview weekends for perspective students.

Winthrop University is a primarily undergraduate public school with 67% of student population being female and 40% being African-American/Black. A large source of funding for undergraduate research comes from a South Carolina Idea Network for Biomedical Research Excellence (SC-INBRE) and one of Winthrop's initiatives as part of the grant is to promote diversity of underrepresented and disadvantaged groups in research. While in the Hurlbert lab—an INBRE funded lab—I had the opportunity to train younger members of the lab including two women who are now in graduate and pharmacy schools.

A year and a half after I graduated, I was invited to be part of a career panel for my former department to talk about my industrial work experiences. I continue to communicate with the faculty at Winthrop, and I hope to again speak to undergraduates that are in the same place I once was, encouraging them to pursue post-graduate and professional studies, and to seek out undergraduate research experiences.

Each year, the Steiner lab takes in undergraduate students from the Strong Children's Research Center (SCRC) Summer Training Program. I plan to involve students from this program in my research project, helping to train them in lab techniques and experimental design.

While in graduate school, I will seek out new leadership roles as I did at Winthrop, and mentor undergraduate students as part of the SCRC program. As a graduate student member of the American Society of Biochemistry and Molecular Biology (ASBMB), I intend to share my perspective on graduate school and how having taken two gap years has better prepared me for the long haul.

Career Goals: I find chromatin biology fascinating, and we have so much left to understand. Following completion of my Ph.D., I plan to continue to do research in the chromatin field in either an industrial or academic setting, while continuing to mentor younger scientists and become more involved in leadership roles related to science policy. I'm passionate about science, and the NSF Fellowship would give me the freedom share my passion for science with others.