Patience, persistence, and humility have been the foundation of my path towards pursuing my purpose. This daily exercise in growth has primarily arisen from my own retrospective look at opportunities and experiences I have been allotted, either independently sought or from the gracious support of mentors. As a female second-generation [redacted] American, my path in engineering is far from expected; yet my motivation is sustained on the prospect of making a place in the world. For me, this place involves biomedical research, sustainable medicine, and ultimately improving health disparities and the quality of life for many.

Intellectual Merit

On [redacted] I led [redacted] University's entire graduating class as **Senior Class Marshal** and thereby received my Bachelor of Science degree in Bioengineering. Even more humbling I received two other University-level awards, the **Chancellor's Award for** [redacted] **and the** [redacted] **Scholarship.** I also received a College of Engineering-level award, the [redacted] **Award for Best** [redacted] **Senior** and a department-level award, the [redacted] **Award** for my demonstration of outstanding and wide-ranging skills. Although graduating was a tremendous feat, I knew that my path in academia would not end there. A graduate education is the opportune next step necessary for me to further build on the exploration and implementation of my ideas freely. Furthermore, being in a hub of education and research will provide me the unique opportunity to build relationships with other graduate students, professors, hospitals, and companies. These connections will be essential for my career as an entrepreneur and researcher. The National Science Foundation Graduate Research Fellowship Program (NSF-GRFP) will give me access to experiences that I may not have otherwise. Although I received Honorable Mention for the 2016 application, receiving the grant this year will supply the leverage needed to seek positions in labs based on interest and the research without financial restrictions or grant limitations.

I decided to take a year between my undergraduate and graduate education to gain more research experience. In our increasingly interconnected world it is important to have independent, international, and diverse experiences to improve cultural competency, executive function, and interpersonal skills. I initiated contact **and received a grant to do research at** [redacted] **in the laboratory of Professor** [redacted]**.** Prior to starting at [redacted] **I developed the collaboration between the** [redacted] **lab and Professor** [redacted] **lab at** [redacted] **by working as a researcher in the** [redacted] **lab.** In the [redacted] lab, I learned stem cell culture for human induced pluripotent stem cells (iPSCs), as well as microfabrication techniques for the creation of magnetic and polystene microraft arrays used as culture surfaces for cell sorting. I investigated various surfaces, the use of cell strainers, and other cell culture parameters to ultimately improve culture protocols for iPSCs on microarrays. This collaboration will continue in February where I will continue to work in the [redacted] lab. I will be building on the research I have started in [redacted] fabricating gels from decellularized ECM as a cell culture surface to study the angiogenic capacity of primary human mesenchymal stem cells (MSCs). I am also exploring how gene expression of hematopoietic markers changes during osteogenesis. At [redacted] I will develop my skills in confocal microscopy, flow cytometry, qRT-PCR, protein extraction, and FACS with the ultimate goal of publication.

Organizations and institutions such as the Ronald E. McNair Scholars program, Louis Stokes Alliances for Minority Participation (LSAMP) program, [redacted] **department of engineering, the Honors program,** [redacted] **Scholars program,** [redacted]**, and NSF-REM-EFRI have supported my research.** I

have had the opportunity to present my research projects at national and international conferences and professional society meetings. Here, **I have won awards and prizes based on the complexity, execution, and delivery of my work** as I cultivated my communication and educator skills. Beyond this, I have been asked by the College of Engineering and Computer Science and the Honors Program to be on panels, moderate events, speak on my experience as an engineer, and a keynote speaker at an Honors Student Welcome Dinner.

One of my first and longest research experiences was in [redacted] research group at the [redacted] Biomaterials Institute. My first project was **highly interdisciplinary, combining computer science, mathematics, and biology** to develop a graphical user interface for automated cell tracking using MATLAB. This allowed any interested user to use the tool without coding knowledge. During my sophomore year I primarily focused on an automated cell-tracking project where I assisted with manual tracking of cells to verify a cell-tracking algorithm. My contribution resulted in an **acknowledgement in the publication.** Ultimately I began my own Honors Capstone project during my junior year, where, I created a noninvasive and automated approach to identify different cell types or subtypes *in vitro* and to characterize cell motility. This tool will lead to more efficient strategies for characterizing cell subpopulations with distinct motility behavior related to tissue development, regenerative medicine, and cancer. For this project I designed and optimized a co-culture model using endothelial cells (ECs) and smooth muscle cells. Time-lapse imaging of the system was employed over a 24-hour time period to capture mono- and co-culture migration behaviors for image analysis. This work was **featured in the inaugural issue of** [redacted] **aimed to help guide middle and high school students find top careers, degrees, and pathways in STEM. I am currently processing images from a shape memory polymer-based scaffold for authorship.**

As a summer **NSF-REM-EFRI scholar** after my sophomore year I studied claudins and antimicrobial peptides (AMPs) computationally for better drug delivery and peptide designs. I used molecular dynamic simulations to identify critical protein structure and mechanisms that would otherwise not be known. High accuracy homology modeling, coarse-grained molecular dynamic simulations, reverse transformation, and refinement were employed to predict the claudin structures with relative accuracy. I also used self-assembly simulations to study magainin, an AMP. Novel proteins were tested with preassembled bacterial membranes to analyze the activity and functionality of the peptides.

During the summer after my junior year I interned at [redacted] under the guidance of [redacted], I characterized the spatial and temporal bias of cortical progenitors in the mammalian cortex, specifically using a mouse and ferret model to further understand brain development and structure. A ferret model was employed to retrospectively analyze excitatory neurons in postnatal brains that were injected with a retrovirus via *in utero* inventricular injection to label dividing radial glial cells in the cortical area. Clusters of oligodendrocytes and excitatory neurons were found computationally. I also studied the production and organization of inhibitory interneurons in varying embryonic stages in mice. I quantified the cell density of the dividing progenitors that I immunostained in the subventricular zone and ventricular zone. I perfused mutant embryos, sectioned brains, immunostained them, collected confocal images, and analyzed them using ImageJ. I found that the inhibitory interneuron domain and the proliferation patterns are highly dynamic and future studies will further quantify this feature.

My desire to help improve the lives of others was echoed during the summer after my freshman year as an [redacted] Project fellow at [redacted]

[redacted] in the [redacted]. I was able to observe a multitude of surgeries from teeth removal in cerebral palsy patients to breast tumor removal. While viewing various tumors and organs being removed or replaced with either grafts, meshes, or metal, I found myself meticulously studying the materials and equipment used. I envisioned ways that the methods and materials could be improved. This desire was further reinvigorated during courses such as global health, public health ethics, and critical issues in medical anthropology where I learned about the implications of poverty, education, and race on health.

Broader Impacts

My intellectual development emerged from my deep curiosity of wanting to know how things work, coexist, and even the ins and outs of different ideologies and cultures. This curiosity has led me to seek a deeper experience beyond the classroom setting. Working with children has allowed me to keep the little scientist within me that once loved to build bridges out of pasta, collect leaves and foliage, and observe different insects in their environment. I know the power of mentorship and guidance through my own growth. My achievements are not only for personal interests or scientific discoveries; it is also for the young students of color whom I interact with. I want to empower them to pursue their desires. I want to take part in paving the way for those not here yet and for those who were unable to. To be the ignition for other younger students **I have served as a tutor, academic enrichment specialist, a volunteer at STEM museums, zoos, science festivals, a community service intern, and leadership positions in professional societies.** The different roles and aspects of my life are not isolated or haphazard. During the fall and spring semester of my senior year **I designed and led five experiments at an afterschool program for children ages 7 to 15 at the** [redacted] These experiments were supported by a grant I received from the Honors Program. The experiments and demonstrations included a lima bean growth experiment, pasta bridge building, oobleck (colloid), making ice cream, and DNA extraction from strawberries. As a member of a university board for an annual MLK event I was introduced to a nonprofit organization through another member. The non-profit, [redacted] Region Science and Engineering Fair or [redacted] creates STEM kits for young students used in [redacted]. I inquired about developing a kit of my own and was given the opportunity to expand the oobleck experiment that the students at [redacted] enjoyed the most based on surveys at the end of the experiments. **In collaboration with** [redacted]**,** [redacted]**, and** [redacted] **City School District, I created a scientific kit entitled "The Wonders of Oobleck" based on creating colloids from different starches and water.** I also assembled a group of volunteers at a community event serving hundreds of students. The completed kit is currently a permanent kit for [redacted].

Each new day is an opportunity for development. I look at all of the experiences put before me, especially education, and am motivated to make the preparations necessary for a career in biomedical research. I think about other individuals who may not have the possibility to place education first. Education is one of the most important things in my life because it has been an immeasurable tool. It is something that cannot be stripped away like titles or money. What I will learn while obtaining my PhD from collaborative research projects, mentors, courses, and even the process studying and taking qualifying exams, I will inevitably use for the rest of my life. Obtaining a PhD will give me a seat at the table and a chance to cultivate and refine my skills so that I am not limited in opportunities. So with this, I ask with humility for your help. The financial stability and prestige that comes with receiving the NSF-GRFP is unmatched. As I transition to a graduate program, I will continue to mentor, learn locally and globally, with the goal of adding value to the classroom, lab, and in the lives of people.