Drinking a hot coffee at 1am while driving down the same hundred mile stretch of unlit highway in South Texas for the second time in six hours is a weird way to spend a Friday night. And yet, in October of 2018, that is exactly the situation I found myself in. I drove from San Antonio where I presented a poster at a national conference, to Corpus Christi where I captained my D1 collegiate soccer team during a vital match, then back to San Antonio where the conference award ceremony was occurring the next morning. Despite how unbelievably tired I was, I smiled through all four hours of my drives. That smile came from the acknowledgment that I was living my dream: I got to tell the world, or at least any of the 4,200 people attending the SACNAS 2018 conference who would listen, the story of my science. The next morning, my poster was **selected out of the 1000+ presentations as an Outstanding Poster Presentation**. I have spent my life chasing opportunities to share information with new audiences. At conferences like SACNAS, I discovered that when the information you share is a product of your own first-hand experiences, love, and hard work, it engages the audience in a profound and impactful way. I hope to continue to find new, creative ways to connect my love of storytelling with my experience in and love of science as a professor at a Primarily Undergraduate Institution (PUI).

Intellectual Merit

My award-winning SACNAS poster told the story of project I conducted with Dr. Chris Bird over the course of the three years during which I became a scientist. It began in the fall of 2017 when I realized some of the limpet shells in Dr. Bird's collection looked vastly different from others despite being the same species. I turned that observation into an answerable question grounded in scientific theory: what biogeographic factors are associated with differences in Hawaiian limpet morphology? I then spent years figuring out how to answer this question. This process was not easy. I first learned how to design an experiment. I searched the literature for information on shell morphometrics, applied what I found by designing many metrics to objectively quantify differences in the shells, and refined the measurement process by trial and error. During the experimental design, I recognized the need for a data collection team to make the process more efficient and provide a means of quality control. So, I implemented the leadership skills I gained as the captain of my soccer team by recruiting and managing a team of three other undergraduates to help me obtain morphological data from ca. 600 limpet shells.

I then spent two years learning how to perform data analyses with programming tools such as BASH and R. Learning how to code while learning how to perform complex statistical analyses felt like trying to solve a puzzle that came with pieces missing and without a picture on the box. Amid that process, I was also learning how to handle rejection. In 2018, I was not awarded a grant from the Malacological Society of America and in 2019 I was not selected for the Undergraduate Diversity at Evolution program at the International Evolution Conference. Still, I was driven by an intrinsic desire to learn and solve the puzzle I had set in front of myself. I attended three coding workshops, the Cascadia R Conference in Oregon, a BASH-based Metagenomics, and Bioinformatics Workshop in Texas, and a BASH-based Short-Read Data Workshop in Colorado, and eventually became proficient in both R and BASH. I took a graduate level stats course. I kept applying and was awarded funding from the Louis and Stokes Alliance for Minority Participation in Science. I secured other travel funds to go to Providence, RI and present my findings as an oral presentation at the Evolution conference in 2019. At that conference, I learned more about the current evolutionary literature, and I connected results of my work to that evolutionary literature when I published my first **first-author publication in the Journal of Biogeography (**Hamilton et al. (2020) *Journal of Biogeography*. 47(7)).

During this same period, I was also in Dr. Patrick Larkin's lab where I discovered the impact I could make as a scientific storyteller. I was drawn to the importance of his lab's work for local communities; he investigates seagrass beds which provide a wide variety of important ecosystem services while serving as a natural nursery for economically important marine species. I worked with Dr. Larkin to investigate genotypic diversity in local seagrass beds, which is vital to the development of conservation and management plans developed by groups like Texas Parks and Wildlife. Funded by the Welch Fellowship, I spent the summer of 2017 investigating how seagrass genotypic diversity architecture varies across different spatial scales. I conducted local fieldwork, observing how a seagrass bed shapes the coastal marine community and observing the man-made threats to seagrass beds first-hand. I then spent

300+ hours extracting, amplifying, and analyzing genetic data from samples. At the end of the summer, I discovered my love of experienced-based science communication while making a poster for my first ever scientific presentation. I spent hours working on formatting, coming up with so many ways to put everything together and eventually settling on a format inspired by the shape of a seagrass rhizome. The time and effort I put into that presentation resonated with my audience; I was selected as the winning poster presentation at the 2017 MSGSO Annual Student Research Forum. I then gave an oral presentation on the same work at an international conference hosted by the Annual Benthic Ecology Society the following spring (2018). For this presentation, the audience was more focused and the format less restrictive than the poster, so I spent hours reformatting everything and weaving a new narrative to make our story interesting to this new audience. This experience went so well that during the next summer (2019) I received a travel award from the Welch Fellowship to give a reworked version of the oral presentation at another international conference, this one hosted by the Botanical Society of America. My work on this project earned me **co-authorship when it was published in Aquatic Botany** in the Spring of 2020 (Larkin et al. (2020*) Aquatic Botany*. 163). Through my efforts, the story of our work reached a diverse set of audiences both locally and nationally. Due to all of my research and athletic engagement, I was named my university's **outstanding graduate for the Fall of 2019**.

During the past five years, I also gained experience telling stories through two research experience for undergraduates (REUs). In 2018, I participated in an REU with Dr. Mitch Cruzan studying landscape genetics of prairie plants in Southern Oregon. I taught myself SQL, geovisualization in ArcGIS and how to use poorly documented R packages to assist with a large lab project. In 2019, I participated in an REU with Dr. Stacey Smith. This time I was ready to take on a completely independent project, so I designed and refined a novel protocol for quantifying carotenoid pigmentation within petal cells. I identified putative genes responsible for carotenoid pigmentation from the literature and then searched for those genes within transcriptomes I assembled for six Petuneae species. For these genes, I created gene trees to look for differences within the structure of the putative hits and performed a preliminary differential expression analysis between species to identify correlations with pigment concentration.

After graduating in the Fall of 2019, I joined Dr. Carrie Wessinger as a lab technician. In this position, I learned new wet lab techniques and subsequently trained two undergraduates on them. I became a greenhouse manager for the plants used in our research. I taught myself html and css and used them to build our lab website from scratch. I also started three independent projects involving *Penstemon* 1) population genetics, 2) floral morphology, and 3) niche estimations. We are currently writing up the results of one of these projects with plans to submit to the American Journal of Botany this fall (2021).

During each of these experiences, I pursued any opportunity to present my work and become a better science communicator. While working with Dr. Cruzan, I attended a capstone class at Portland State University in which I refined my ability to communicate science with diverse audiences. With Dr. Smith, I presented my preliminary findings as a lightning talk at the international conference hosted by the Botanical Society of America (Botany 2019). With Dr. Wessinger, I presented the results of one of my projects as an oral presentation at Botany 2021. This talk resulted in a discussion so interesting that a post-doc from another lab and I decided to conduct a meta-analysis which we plan to submit as a Perspective in Evolution next Spring (2022).

Stories are more engaging when they are grounded in your own experiences. I have worked in five labs over the past four years, collecting a diverse set of scientific experiences while learning to tell more interesting and engaging scientific stories. Out of the 10 times I have presented my scientific tales at national and local conferences, **I won four awards for outstanding presentations and was awarded external funds to travel to national conferences twice**. Yet the most memorable accolade I have received came after my final presentation to my capstone class at Portland State University when a classmate and fellow undergrad researcher said, "I wish I had a science teacher like you growing up".

Broader Impacts

I love using my various experiences and the stories that come from them to teach others. In high school as a pre-calculus teaching assistant, I helped struggling students grasp new concepts using a combination of my recent experience in the class and novel approaches like songs and acronyms for

complex equations. My freshman year of college, I volunteered as an assistant coach with a local youth soccer club, FC Padre. Each week, I shared my love of soccer and sixteen years of experience with new generation of players as I created new drills for children ages 5-8. My junior and senior years of college, **I worked as a tutor for student athletes, covering subjects from college algebra to genetics to local government**. I combined my knowledge of these subjects with my own student athlete experience to engage these students in courses they were struggling with. Each of these experiences challenged me to connect to audiences at a wide variety of knowledge levels.

Through my experiences as an instructor, I have found that my favorite audiences are the beginners; I find something so satisfying in introducing people to the wonders of a new subject. This has led to my desire to conduct outreach that encourages others to become interested in and passionate about science. In high school, I was a recruiter for our science magnet and spent two days a year out of class, talking with junior high students about the science magnet program. I conducted demonstrations showing how science intersected with their everyday life, and I loved watching their eyes light up when they learned, through a "candy", that a classmate had the allele that makes cilantro taste like soap. My love for outreach was reaffirmed my sophomore year of college when I volunteered to run a room during the Regional Science Olympiad. The room I ran addressed physics and architecture by having teams competitively build towers with only spaghetti and marshmallows.

I was so inspired by these outreach events that I **designed a game-based learning experience for elementary audiences as an outreach project for Dr. Larkin's lab**. To implement the game, we established a connection with the Antonio E. Garcia Arts and Education Center, which promotes art and STEM literacy via an after-school program for children in grades K-5. The game I created involved three teams of children holding hands where each team was a genetically different seagrass clone that was competing with the other clones for limited resources, represented by candy, and each child was an individual seagrass within that clone. This game taught children the basics of what seagrasses are, the value of seagrasses, clonality, resource uptake, and genetic diversity. To assess the effectiveness of the game, I asked a series of wrap up questions to my audience of 20+ children. I knew I was successfully living out my dream as a science communicator when they answered every question correctly.

Future Goals

I will fulfill my dreams of being a teacher and science communicator by engaging both students and local communities as a professor at a PUI. I am particularly interested in pursuing this position because I will be able to focus on my favorite type of learners: beginners.

I plan to utilize the time and funding from the GRFP to develop outreach aimed at elementary aged audiences, which I will maintain as one of my focuses as a professor at a PUI. Using my collaborator's ties to the Morton Arboretum and the Arboretum at Penn State, I will design and implement game-based learning experiences for young audiences at these institutions. I will take components of my research and integrate them into the Morton's existing program "Summer Science Camp" which offers 100+ camps, each of which can be attended by up to 50 children, that create immersive experiences that introduce students to thinking critically about plants and botanical forms. I will also design and implement my own outreach program aimed at local audiences through a partnership with the Arboretum at Penn State. Collaborating with these institutions will give me a platform with the potential to reach any of the collective 2+ million people who walk through their doors every year. I will use that platform to continue learning how best to engage with diverse, local communities starting at an early age.

I will also utilize the time and funds made available to me by this fellowship to focus on recruiting and mentoring undergraduates, the primary learners for a professor at a PUI. I will use my experience mentoring undergraduates and running small scale, high impact projects to lead these students in designing their own independent projects with the goal of publication. I will also participate as a co-mentor through the Hoban lab in the REU program at the Morton Arboretum. This work will further prepare me to engage and inspire beginner audiences in my future career as a professor at a PUI.