Personal Statement

I don't have a perfect academic track record. I stumbled many (bordering on countless) times during my undergraduate career, but I always saw each mistake as another opportunity to learn something, prove myself, and take myself closer to my academic and professional goals. As a "latch-key kid" from a rural island in Hawaii, I didn't have much academic guidance growing up, which was evident in my undergraduate career. While trying and failing at a lot of things, I gained interdisciplinary exposure and saw the universal application of mathematics. While working as a lab technician in the drosophila genetics lab (Robinow-Lab) at the University of Hawaii at Manoa under Dr. Steve Robinow, I learned about how a complex combination of mathematics and cellular biology were applied to genetics research through the field of bioinformatics. At UHERO (University of Hawaii Economics Research Organization) as an undergraduate research intern I recognized techniques I had learned in statistics and linear algebra being applied to big data to produce meaningful results, that I later watched state researchers present to city council members who would use these results to make big decisions on the future of the state's economy. After taking a course in geomathematics with Dr. Janet Becker, I studied how mathematical techniques drawing from subjects like complex analysis, partial differential equations and elementary probability affected information-loss in wave data analysis, and later went on to do a summer research assistantship with Dr. Becker under the USACE PILOT program, studying the effects of wave inundation on fringing reefs using statistical analyses. Our work had applications in flood risk management in coastal areas. I've seen the breadth of computational mathematics and experienced firsthand the enormous outcomes that can be achieved by the tools we employ. These experiences outside of my field are what ultimately led me to pursue a graduate degree in computational and applied mathematics, in spite of coming from an undergraduate department that specialized in pure mathematics. Since finding my path, I have thrived as a student, researcher, and most recently as a teaching assistant. After taking a Numerical Methods course as a graduate student at Southern Methodist University with Dr. Johannes Tausch I pursued him as my research adviser because he challenged my skills and work ethic, and because I admired his history of collaborating with engineers and researchers from other fields.

Intellectual Merit

In my time as a student I've grown a lot as a researcher. My first research experience was working as a lab technician in Robinow-Lab. My primary duties were lab maintenance and I also began to learn techniques of drosophila genetics before moving on. At Robinow-Lab I learned how to work as a team player, in the case that a project has a lot of moving parts and several researchers working towards a common goal in a shared space. I worked as an undergraduate research intern at UHERO from mid-Spring 2013 through Summer 2013, under James Jones (PhD Candidate Economics, UH Manoa) and Dr. Peter Fuleky. I primarily did database management using HEREMOS and data aggregation as individual work for the purpose

of researching state economic development and growth in the real estate sector. This was my first opportunity to be responsible for data that would be implemented in models and presented to non-academics with a quick turnaround.

I began working under Dr. Becker through a one-on-one directed reading course. I would prepare a weekly presentation on a topic of her choosing by searching for then studying relevant papers and texts. Most topics had to do with signal processing applied to ocean wave analysis; in particular, I presented on the derivation of Hilbert transforms and their application in wave analysis, spectral analyses, windowing, and Fourier transforms. I'd had some exposure to these topics in complex analysis, statistics and partial differential equations, but at the time I wasn't familiar enough with anything to comfortably present them to someone else without a lot of studying, and I was very interested to learn about their applications in Oceanography.

After I graduated with my BS in mathematics, I started working for Dr. Becker as a graduate research assistant. Using Matlab code written by Dr. Becker, I ran statistical analyses on different spectral processes using data obtained by several probes deployed in the Marshall Islands and other locations in the central Pacific Ocean. The primary goal of our research was to employ a new model for wave inundation in coastal areas with fringing reefs, which would use a different modal system than previous models. My primary job was running statistical analyses to test the limits of the model under different circumstances to see what conditions the model could reproduce results/data taken in the field. Ultimately, the work I did was presented at the February 2016 Ocean Sciences meeting[1]. Working with Dr. Becker, not only did I get the chance to apply everything I had learned during my undergraduate career, but as a fellow woman and mother she had a profound impact on my choice to further my education. Without having known Dr. Becker, I would have been overwhelmed as a mother in a STEM graduate field, knowing that women face a lot of resistance and obstacles. Working with such a successful female researcher gave me a lot of confidence in my academic and personal achievements going into my Master's program at SMU. Without this experience to pull on, I don't think I would have been ready to begin research during the first year of my Master's.

I began an informal directed reading with Dr. Tausch in February 2016 in preparation for research in Summer 2016. After studying the theoretical and computational methods for solving integral equations, we looked at the problem of the heat equation on an interface with a moving geometry. We hoped that by employing different methodologies, we can improve upon the results of Dr. Tausch's previous student Elizabeth Case in solving the heat equation for an interface with a moving geometry. One of the benefits of doing research while attending courses is that each day I learn another tool to add to my arsenal. I've already been able to employ techniques that I learned in my Numerical Methods courses, like quadrature methods and linear system solvers, as well as numerical solution schemes for heat equations with point sources, which we studied in Mathematical Biology. My current research contrasts with my past experience, as I have taken a prominent role in developing the model, running analyses and

assessing my own work. We are in the final stages of testing our model, and will begin writing a paper in the coming months. We hope to expand upon this topic and do further research once we have finished studying this more general case, and we will continue to work together on my PhD thesis after I graduate with my Master's degree in May.

Broader Impact

As a student from an under performing public school on a rather undeveloped island in the Pacific Ocean, people have always told me to set my sights lower. Since I began my academic career, I've felt a strong pull to encourage and facilitate other students' interests in STEM fields, mathematics especially.

During my undergraduate education, I worked as a K-12 and University STEM tutor through the Online Learning Academy, which was run by the University of Hawaii at Manoa under a state grant provided to encourage STEM participation in local public schools. I also served as a mentor for the Ka Pilina project, which was funded by the U.S. Department of Education and aimed to engage 7-12th grade Native Hawaiian, female and disabled students and their families in mathematics, and promote positive attitudes toward STEM fields. I was the President and Founder of the Manoa Mathematics Club at UH, which I started to facilitate a mathematical community within our department. By holding colloquia and informal talks, I was able to start an interesting interdepartmental dialogue between professors, instructors and students on topics ranging from Brownian motion to mathematical finance.

I hope to continue my work with underrepresented groups through community outreach by getting involved with the local SMU-UTD SIAM student chapter. Through my work as a teaching assistant I've had the opportunity to lead the undergraduate scientific computing recitation. A majority of my time with the students is spent teaching them Python, and many of them have no programming experience. I've found taking an active role in the students' education and learning experience to be immensely rewarding. Helping students who think they cannot be helped has always been my greatest challenge and success as a tutor, mentor and now as a teaching assistant. Although my main interest is research in computational math, sharing my experiences has always been an integral part of what drives me. As an aspiring professor, I see myself contributing to mathematics and industry with meaningful research as well as providing the mentorship that is so critical to the success of students.

Future Goals

The research that has been most meaningful to me is that which was interdisciplinary and had real-world, industrial applications. This is what originally drove me to pursue computational mathematics, and leave (for the most part) pure mathematics behind. I have a wide range of experience as a researcher and educator that would make me an asset to any STEM environment. My ultimate goal as a mathematics professor is to continue to facilitate interdepartmental collaboration and uplift and inspire students to pursue their academic interests, regardless of

what cards may be stacked against them. I would be grateful and honored to have the support of the National Science Foundation behind as I continue my career and achieve my goals in changing mathematics and students' lives.

References:

(1) Agustin, A., Becker, J., Deyerl, N., & Merrifield, M. (2016, February). EC24C-1128: Climatological Effects on Extreme Shoreline Water Levels at Ipan Reef, Guam. Poster presented at the annual Ocean Sciences Meeting, New Orleans, Louisiana, USA. Abstract retrieved from https://agu.confex.com/agu/os16/meetingapp.cgi/Paper/89918