Personal History: I am a Jenga player who grew up in a household of jigsaw puzzle enthusiasts. My family would pour the pieces out, prominently display the picture on the box, and methodically recreate the image in front of them within hours. I hated jigsaw puzzles. How can they be fun when the solution is right in front of you? Jenga required precision and forethought to win and I loved how the game evolved, increasing in complexity with each players' turn.

When I started high school, **I realized that even though I may hate jigsaw puzzles, I am one.** A single complaint of aching knees as a child quietly morphed into a constant stream of physical nuisances. As my symptoms grew more severe and disparate, my drive to find an answer found solace in the local library. There, I spent hours after school reading everything I could about the human body. I was becoming increasingly defined by an invisible illness, searching for invisible answers to invisible questions. Despite symptoms growing to define my daily life, I faced constant dismissals from professionals and family, compounded by piles of medical tests showing that, on paper, I was perfectly healthy.

Through these hours in the local library, my proclivity for research began. I developed that spark in areas outside of my own illness— researching everything from infectious disease to British literature. In college, by pure serendipity, I stumbled into a geology class and declared my major the next day. Geology emulated the ever-evolving complexity of Jenga, and it promoted the balance of adventure and precision I craved. When I started my first major research project examining crystal size distributions to determine the cooling history of an igneous lens in Iceland, **I realized that I like *scientific* puzzles, just not jigsaw puzzles**. But my health cut my time at [college I transferred from] and my research short.

In 2018, a diagnosis of Ehlers-Danlos Syndrome (EDS), a rare genetic disorder resulting from incorrectly constructed collagen, became the picture on the front of the puzzle box, showing me exactly where all the pieces fit. Equipped with this name, I refined my research efforts; picking apart the mechanisms of the disease, resulting complications, and the constant joint dislocations, that come with faulty collagen. **EDS has not diminished my unabashed enthusiasm and unstoppable drive in my schooling and research career— it has only made my desire to be the best at what I do stronger.** Stronger than my joints are, that's for sure.

Intellectual Merit and Research Experience: School has always come naturally, even when my health hit lows, my grades stayed high. Like a sponge, I can sit in class, absorb the information, and regurgitate it on an exam with little effort. Because geology is the application of chemistry, physics, and biology to ever-changing earth processes, it requires much more than absorption of facts. I was invigorated by this paradigm shift in my learning and I purposefully took geology classes that *scared* me. Knowing that I struggle with spatial manipulation and 3D thinking, I tackled structural geology and then took two extra structural geology field classes which, if nothing else, taught me the **importance of stupidity**[1]. A semester of learning environmental geochemistry, followed by a semester of geochemical field work marred by real-world chemical complications, was the most frustrating, most challenging, and most rewarding academic experience I had at [university to transferred to]. **Initially, I struggled to understand where my coursework fit and how I could actually use the concepts I had diligently studied— then, I saw an ad to apply to work in a geomicrobiology lab.**

I joined Dr. T's geomicrobiology research group during my junior year. My first task was to complete a full petrologic analysis of over 100 thin sections from the Samail Ophiolite in Oman. Fresh out of petrology, I was surprised to see globs of an amorphous and optically unusual mineral across these thin sections that neither I, nor the lab manager, could identify. Using Raman spectroscopy, a technique that allows for mineral identification based on chemical

structure, I made a shocking discovery: all that optically unidentifiable gunk was garnet. **Garnet, in that amount, had never before been documented in any other serpentinizing system and shouldn't have been geochemically stable— but here it was**. My job as a research assistant turned into an independent project to characterize the garnet and its surroundings by learning a host of geochemical instrumentation. This was my new puzzle without a picture, and fortunately, I had better tools this time.

I initiated collaborations with other departments, local schools, and the USGS where I imaged my samples with a scanning electron microscope, created element maps on a transmission electron microscope, and analyzed the water content of the garnet on a Fourier-transform IR-spectrometer. My curiosity drove me, and I fearlessly dove into the investigation regardless of my unfamiliarity with a new instrument or technique. Even a grueling and memorable 13-hour day on the electron microprobe, proving the garnet was highly hydrated, left me energized. My advisor recognized the excitement on my face and exclaimed, "I *knew* you were an e-probe person!" To this day, that comment makes me laugh. **What started as a simple question of identifying unknown gunk turned into a year-and-a-half research project dedicated to understanding where garnet fit in the biogeochemical puzzle of the Samail ophiolite**. These results told a story about the potential for microbes to live extreme subsurface conditions, which I presented at [conference] in 2018. A whirlwind week immediately followed [conference]: I graduated from [university] with distinction and was offered positions as a research technician to continue my work with Dr. T, join [lab] with Dr. F, and start research with Dr. K. I accepted all three positions.

My introduction to thermochronology was a methods development project: we needed to develop and implement a solution to a problem that has been plaguing (U-Th)/He thermochronology since its conception— estimating the uncertainties associated with alpha-ejection corrections for apatite. Ultimately, we aimed to develop a universal guide for researchers to estimate the uncertainties on alpha-ejection based upon grain size, geometry, and surface roughness. Over 8 months, I organized and classified over 400 apatite grains and collaborated with [university]'s Mechanical Engineering Department, where **I became the first trained unassisted user of their NSF-funded X-ray Microscope**. I learned scientific creativity as I meticulously designed mounts which housed 50 apatite grains on the head of a pin, **to achieve the highest resolution images of apatite ever published**. I presented this research at the 2019 annual [conference] meeting, where **I was awarded 'Best Poster Presentation' by the [conference]**. Currently, I am drafting a manuscript which details my findings and how they will increase the accuracy of apatite (U-Th)/He calculated ages by assigning proper precision to alpha ejection corrections.

My work with Dr. K has been a thrilling dive into an area of science I was initially terrified to step into: geophysics and computer science. I have learned basic command-line coding, the essentials of satellite imagery, and how to make paper-worthy figures with Generic Mapping Tools on a [institute]-funded summer trip to Scripps Oceanographic Institute. I am ending my time there on a high note as I continue to work on a NASA-funded project to analyze landslide initiation, detection, and classification.

I realized that I had an opportunity to combine the geochemistry and the thermochronology I explored in my research experiences and that the expansion of the intersection of these two disciplines could provide answers to questions that have eluded geologists. **I will use geochemical methods to answer questions of chronology and use thermochronology to unravel geochemical puzzles. I am well qualified and supported to pursue this passion during my doctoral career.**

Broader Impacts: **My history as an educator for K-12 students, college students, adult learners, disabled people, queer folk, geologists, and non-scientists of different abilities and backgrounds is long-standing and integral to my core values as a researcher and a scientist.** I started as an undergraduate teaching assistant (UGTA) for a Natural Hazards class in 2013. Since then, I have been a UGTA for both introductory and advanced geology classes including Introduction to Geology, Mineralogy, and Petrology courses. I strive to create an open learning environment by admitting my own mistakes and gaps in knowledge and holding office hours in ADA-compliant buildings and classrooms on campus. In one of my office hours, the day after the 'drop period' ended for a particularly difficult class, a group of students stopped in and explained, "We were going to drop this class, but we didn't because we feel confident after your office hours." Regardless of the class or the students' backgrounds, the most rewarding moments for me are when they feel confident in the material because confidence is key to their success inside and outside science. The personal connection I build with students and seeing their growth as learners is what **compels me to seek a career that allows for meaningful mentorship.**

During my year as the Academic Chair of [fraternity], a gender-inclusive honor fraternity, I worked on communicating science in a physically and mentally accessible way. I hosted "Rock Talk" walks through [county, state] where I would tell the geologic story of the iconic [geologic feature] and why they are so striking against the backdrop of the mountains. At an event called 'Brother TED Talks' where members of the fraternity present on anything they want, I explained my geochemical research with Dr. T to 60 non-geologists. I received feedback **commending my ability to make a complex topic understandable.** I continue my work to make scientific literacy, geology, and pursuing graduate school less daunting idea through my job as a science writer for [department] at [university] and as the creator of my blog which has garnered an active audience during this admissions season.

My desire to become an academic leader as a disabled and queer person became undeniable at the Expand Your Horizons (EYH) event where I led a group of middle school girls to STEM workshops. Joining my students for lunch, one opened up to me about her involvement in her school's Gay-Straight Alliance and how scared she was to come out to her mom as gay. I saw a younger version of myself in her, and I knew that as a middle schooler, I would have benefited from seeing someone like myself thriving in a career devoid of queer women. Maybe I would have pursued my passion for geology sooner if I had that representation.

Science is me lecturing while using a cane, it is the rainbow flag pin on my bag, and it is admitting when I don't know the answer. Science is disabled people, women, queer folk, people of color, and scientists confident in their uncertainty. Science is as much research and teaching as it is community.

Future Goals: During my time as a PhD student I will use this fellowship to advance the frameworks through which geologic events are understood and assessed. I will improve my own scientific communication skills by teaching basic scientific literacy to younger students, adult learners, and disadvantaged populations through my tutoring network, contacts with local public schools, hosting EYH workshops, and blog, **so that my research is accessible outside scientific journals**. After my PhD, I will pursue an academic career where I can be visible and intentional in making geology accessible and safe for everyone. I will lift life-long learners up to become life-long researchers and scientific storytellers. I intend to make research an opportunity for everyone who wants to feel the bliss of finding and fitting the last piece of a scientific puzzle.

References: [1] Schwartz, M. A. (2008). The importance of stupidity in scientific research. *Journal of Cell Science*.