I never thought I would escape my hometown. Solon, Iowa is a small community of approximately 2,000 people — nearly all farmers fettered to the land, imprisoned by their open fields under a blue sky. They are born and raised in Solon, marry someone from Solon, and most would likely die in Solon. Their children grow up in Solon and most repeat the cycle anew. I decided early this would not be my life: I resolved to instead cultivate a passion and take advantage of whatever opportunities I could find. My studies took me to the coasts, where I now try to make up for lost time, seeking out as many diverse experiences as possible. However, I often think back to my roots, and I now realize how my upbringing has fueled many of my aspirations as a scientist. I feel a deep sense of responsibility to repay my community, and I wish to use my science and my platform for their benefit. I hope to not only develop myself as a scientist and communicator, and eventually use what I learn to make science accessible to all. I believe I can best achieve these goals first as a graduate student, and one day as a professor.

Intellectual Merit: I cannot remember a time when I was not drawn to biology. Even before I knew what science was, I loved the complexity and richness of nature. Growing up, I was particularly fascinated by the human body. A biologist my family knew growing up piqued my interest: he both answered all of my questions and left me with many more. One time, I asked him how our fingers moved, and he ended up telling me all about ligaments and muscle fibers. He simplified intimidating concepts like 'receptors' and 'diffusion' so even as a child, I understood. When I began high school, I leapt at the opportunity to study under him, and spent 3 years in his laboratory at the University of Iowa. I began studying the genetics of colon cancer by helping a postdoctoral fellow with basic experiments. Eventually, I started my own independent project tracking the intracellular localization of BMPR1A, a protein linked to colon cancer. **My projects in high school yielded me a fifth-place finish in the national Siemens Competition, as well as two publications as first and co-author.**[1,2] These first years with him left me with an insatiable thirst for knowledge. To my advantage, I learned the scientific method and how to do research, giving me the first few tools I could use to answer my numerous new questions.

Having developed a passion for research, I decided to major in biology with a focus on genetics during my freshman year at Dartmouth College. I immediately sought out a research position and began working in Dr. Bryan Luikart's lab shortly thereafter. Like my mentor in Iowa, Dr. Luikart worked in cancer genetics, but focused on cancer in the brain instead. I was independently tasked with finding the function of miR-338-3p, an enigmatic microRNA highly expressed in the brain. When the microRNA is knocked down in the hippocampus, abnormal clusters of cells form within a few weeks. I then induced miR-338-3p expression in brain cancer cell lines, and to my surprise, the cells expressing miR-338-3p began dividing much less quickly! This was my first real unexpected result as a scientist — I first tasted the thrill of discovery, which continues to motivate me today. With these data, I secured an independent research grant from Dartmouth to support additional experiments over the next year to explore the link between development and cancer. and discovered that miR-338-3p is crucial for normal neuronal development: neurons lacking miR-338-3p had deformed morphology. My junior year, this work earned me Dartmouth's Presidential Scholarship to support my research. Those cell clusters turned out to be glioblastoma, the most common and most malignant form of brain tumor, and I discovered an inverse relationship between its severity and miR-338-3p expression. **This work resulted in a first-author PLoS ONE publication.**[3] From these experiences, I learned how to independently conduct experiments, how to parse the specifics of complex systems and their interactions, and most importantly, I developed a strong sense of my independence as a scientist.

I initially joined the Luikart lab because I was interested in cancer, but through the course of my work, my interests shifted. I became drawn to the brain, especially the hippocampus , partially due to a broader obsession with memory. I eventually changed my major to neuroscience and contacted Dr. Alcino Silva, a memory researcher at UCLA whose elegant studies into the nature of memory deeply inspired me. He took me on as an intern for six months before my senior year, where I ran a systematic review to determine whether mice are suitable models in neuropsychiatric drug development, a controversial issue in pharmaceutical research with far-reaching and costly implications. I found that all neuropsychiatric drugs studied known to be effective in humans were effective in mouse models as well. To strengthen the support for our bold claim, I coordinated with eight notable neuropsychologists to cross-validate our results and contribute to the review. Throughout this project, I learned how to critically interrogate the literature and collaborate across academia. **Our review was published in Current Biology this year, with me as the lead author.[4]**

By the end of my internship at UCLA, I knew that graduate school was the right path for me. I loved doing research full-time with Dr. Silva: I was undeterred by the long hours, and even began thinking about neuroscience in most of my free time. I returned to the Luikart lab for my senior year to complete my studies. I had earned near-total autonomy and funding to finish my experiments and write my thesis, supported by a second independent research grant. I successfully designed and completed multiple *in vivo* glioblastoma implantation experiments, mentored a freshman undergraduate to take over my projects in the lab after my departure, and finally defended my senior thesis. Upon graduation, my work earned me **three departmental accolades and three school wide awards: a commendation for excellence in science, outstanding student researcher, outstanding thesis in neuroscience, nomination for outstanding thesis in the sciences, high departmental honors, and *cum laude* Latin honors**.

At this point, my next stage was clear. I was drawn to UCSD's Neurosciences Graduate Program for a number of reasons, including its numerous up-and-coming young faculty, its focus on producing well-rounded academics, and its emphasis on public outreach in addition to pure research. I arrived in my doctoral program with an ambitious study in mind that aimed to bridge the gap between evolutionary genetics and behavioral neuroscience, to determining how we inherit our innate fears of specific stimuli like snakes and spiders. I intended to meet a mentor who would want to pursue this question with me. I found a potential advisor in Dr. Cory Root, who had arrived at a similar idea after discovering the function of the cortical amygdala, a region of the brain responsible for innate olfactory fears in mice. To work on bringing our shared ideas to fruition, I joined his lab. I currently spearhead a project to define the molecular genetics of specific innate odor aversion in mice. Now at the beginning of my second year, I have already formed partnerships with three other research groups to move my project forward: one in bioengineering here at UCSD, one in biology at the University of Cincinnati, and another in chemistry at UCLA. I have also completed the first version of my data analysis pipeline and developed protocols of my own, sharing them open-source and for free on GitHub and protocols.io, respectively. I have also been invited to give an hour-long research presentation about drug development and disease modeling to UCLA students and faculty this year. I am very excited to continue the work that I am already doing.

My ultimate goal is to become a principal investigator, leading my own laboratory and mentoring students. We know little about the relationship between our genome and our behaviors, as mediated by our brains' specific circuitry, but its investigation could have great translational potential. Application of this end-to-end approach will provide solutions to long-

standing problems in psychology, developmental biology, education and many other diverse fields. For example, pharmaceutical companies could target these genes to treat psychiatric diseases, which disproportionately affect people living in rural communities like my hometown.

Broader Impacts: As a developing scientist, I find it striking and disappointing how far removed my discipline is from daily life. When I arrived at Dartmouth, I immediately noticed how strangely siloed off science was from the overall community. Conversations with classmates touched on economics, literature, and philosophy, but science was rarely brought up. I wanted to discuss these topics, but they just could not penetrate popular consciousness to the same degree. **I subsequently began writing for the Dartmouth Undergraduate Journal of Science, to learn how to better communicate science to the lay public.** I covered stories at the intersection of science and society, like how genealogy can be used to discover the ancestral source of a family's genetic traits. I eventually became the journal's president, where I was responsible for a quarterly circulation over a thousand copies and a website with more than 40,000 monthly views.

My belief in science communication's importance has not waned since beginning graduate school. I am an active member of NeuWrite San Diego, where I write my own pieces, edit other contributors' submissions, and mentor newer writers. I am also currently an independent science journalist for various popular media sources, including multiple nationally-recognized media outlets. My bylines have appeared in Salon, RealClearScience, and Massive Science, among others. Recently, I was hired to report on the annual meeting of the Society for Neuroscience, the largest scientific society in the world. As a communicator, I do not just publicize science on my own, but I help build and maintain its needed infrastructure.

I have also made considerable efforts to increase science's accessibility to those historically excluded from its pursuit. While in college, I organized STEM@Dartmouth, a discussion targeted towards first-generation college students which offered advice on how to succeed in the sciences at Dartmouth. We advised these students on everything from selecting intro courses to beginning lab research. In September, I moderated a panel for ComSciCon San Diego, a conference devoted to making scientists better communicators. My panel discussed how to break into science journalism, taught attendees how to pitch ideas, how to communicate with lay audiences, and sources for opportunities without an established network. **I personally took steps to ensure underrepresented communities had their voices heard; both panels featured majority female and majority person-of-color composition as a direct result of my efforts.** However, interest in science begins much earlier than in higher education. As a result, I frequently volunteer with UCSD's Neuroscience Outreach Program. As a part of this program, I travel to underprivileged, majority-Hispanic K-12 schools around San Diego. I employ active learning strategies in the classroom (where students are most comfortable) with fun and fascinating materials — such as a dozen different animal brains, as well as a machine that lets kids control insect legs using only electrical signals from their cell phones.

I will continue teaching and writing during graduate school, helping put neuroscience into the discourse both at large and in San Diego. In the future, I will continue communicating science as a public intellectual and a professor, drawing the attention of the next generation and training the next generation of scientists. I hope to one day use my platform to bring science into rural towns like my own, serving as a mentor and advocate for people away from traditional centers of research and higher education. One day, I hope that a student from Solon could have the same opportunities as a student from Cambridge, and I am uniquely suited to make it reality.

References: [1]Dahdaleh et al. *J Surg Res* 2011 171:e15-20. [2]**Howe** et al. *J Surg Res* 2013 184:739-745. [3]**Howe VI** et al. *PLoS ONE* 2017 12:e0177661. [4]**Howe VI** et al. *Curr Biol* 2018 28:R909-914.