I am a dedicated and ambitious researcher, intent on performing high-quality work that integrates across subfields of biology. In addition, I'm passionate about my research environment; I believe that good research depends on having a good community, and I go out of my way to support my colleagues and the next generation of scientists. In this statement, I will describe how my past experiences have shaped my outlook and merit as a researcher, and lay out my ambitions for the future in terms of both my own training and my impact on others in the scientific community.

Intellectual merit

I'm a second year graduate student in the Ecology, Evolution, Genetics and Genomics PhD program at the University of Rochester, but I took an unexpected path here. I went to a small liberal arts college and expected to major in history or English. During my sophomore year, though, I took an introductory biology course and abruptly discovered my passion for biology. I was fascinated by lectures on topics like sexual and asexual reproduction, horizontal gene transfer, and phenotypic plasticity. In the teaching lab, I enthusiastically pulled on chest waders and headed to a local pond, where my classmates and I used mark-recapture to estimate the size of the pond's population of three-spined stickleback fish (*Gasterosteus aculeatus*). I was hooked.

One of my professors from introductory bio, Dr. Suzy Renn, noticed my enthusiasm and invited me to join her lab that summer. Under the guidance of Suzy and our collaborator Dr. Pete Hurd, I spent my final two years of undergrad, plus one year as a post-bac researcher, working on a project that we jokingly nicknamed "MethylNads". As I'll demonstrate, this project came to shape both my interests and my outlook as a scientist.

With the MethylNads project, I worked to understand the mechanistic basis of environmental (water pH-based) sex determination in a cichlid fish, *Pelvicachromis pulcher*. We hypothesized that aromatase gene promoter methylation could play a role, as this mechanism had been observed in fish, turtle, and alligator species with temperature-based environmental sex determination. To test our hypothesis, I sequenced the *P. pulcher* aromatase genes and associated regulatory regions, and then designed and tested an Illumina-based bisulfite sequencing assay to detect methylation of select regions of the promoters. I traveled to Pete's lab at the University of Alberta in Edmonton, AB to rear *P. pulcher* fish for our study and collect tissue samples. I quantified methylation levels in samples from juvenile fish that I collected myself, and in adult tissue samples collected by members of the Hurd lab. I also used RT-qPCR to assess aromatase expression levels in matching samples for comparison.

I had a considerable amount of responsibility and independence as an undergraduate researcher, a major advantage of being at a small, undergrad-only liberal arts college. As the only student on the MethylNads project, I was able to help guide the direction of the project and was responsible for the vast majority of the hands-on work. This meant that I was constantly learning new techniques, from bisulfite treatment to fish husbandry to Illumina library preparation and, later, data processing with bioinformatics tools. When I started on the project, fresh out of introductory bio, I barely knew what PCR was! MethylNads was a trial by fire for me. I gave it my all, and thrived on the challenge. I also helped to fund my research by applying for small grants through my school, including the Reed College President's Summer Fellowship, which allowed me to travel to Pete's lab at the University of Alberta for the summer of 2016.

Ultimately, we found that aromatase gene promoter methylation is elevated in male *P. pulcher* fish compared to females, while aromatase expression is reduced in males (expected since this type of methylation acts to suppress gene expression). In thirty-day-old juvenile fish, which are too young to have developed gonads, principle component analysis of methylation patterns nonetheless revealed variation corresponding to the differences observed between adult

fish of different sexes – the beginnings of sex determination! Alongside my mentors, I helped to write a manuscript describing this work which we submitted to the Journal of Neuroendocrinology (**Driscoll** et al. in prep). For me, the writing process was an incredible lesson in the challenges – and the value – of scientific communication. I also presented this work at the 2016, 2017, and 2018 Society for Integrative and Comparative Biology meetings and the 2017 Animal Behavior Society meeting.

My experience with the MethylNads project shaped my interests and outlook as a scientist. I learned to employ three complementary approaches to my research: working with live organisms and doing experimental manipulations, using molecular biology techniques, and employing bioinformatics and computational tools. I developed an enduring interest in environmental effects and plasticity, and strive to ask integrative, interdisciplinary questions that lie at the crossroads of ecology, genetics, evolution, development, and physiology.

Given my passion for research, I decided to pursue a PhD in order to continue my training and further develop my skills as a scientist. I followed my interests to Dr. Jennifer Brisson's lab at the University of Rochester. My graduate work focuses on the evolution of phenotypic plasticity, with pea aphids as my study system. Though many gardeners know these insects solely as pests, aphids exhibit a fascinating wing dimorphism in which asexually-reproducing adult female aphids may be either winged (investing in dispersal) or wingless (investing in fecundity), depending on the environment. There is considerable variation in the degree of plasticity between different populations of pea aphids, and even between different lineages in a single population. Thus, pea aphids are an ideal system in which to study the evolution of phenotypic plasticity, in order to understand the genetic and ecological drivers of this widespread source of phenotypic diversity. I discuss this further in my research proposal.

The University of Rochester is an excellent place to study evolutionary genetics, as my department is full of amazing researchers studying many different topics in evolution. During my first year, I took a two-semester course co-taught by six different professors covering important topics in evolutionary biology, which allowed me to gain breadth in my field. I also completed rotation projects in three different labs, exploring different subfields, learning new skills, and working with many different people in my department. I am currently working with Dr. Nancy Chen to publish work on scrub jay population genetics that I carried out while rotating in her lab.

My long-term career goal is to obtain a tenure-track faculty position at an R1 institution. I remain committed to integrative, collaborative research, and to my three approaches – live organism work, molecular techniques, and bioinformatics. I also eagerly anticipate the opportunity to teach and to mentor younger scientists, as well as to foster good scientific community among my colleagues and peers, as I will discuss below.

Broader impacts

An unexpected path brought me to biology and then to research, as I noted above. It never would have occurred to me to change my major and pursue biology if Suzy hadn't invited me to join her lab. Throughout my scientific career, I've benefited greatly from good mentors who guided and advised me, as well as from a broader community that supported me and made me feel at home. My experiences have motivated me to pay it forward by mentoring younger scientists, and by building a good scientific community for my peers.

I know firsthand how much of an impact good mentors and good teachers can have. Without my mentors, I wouldn't be a scientist today! When it comes to building a strong scientific community, my first goal is to encourage younger people to go into science.

With the Brisson lab, I've taken on outreach to middle and high school students in order

to encourage them to go into science. This summer, my labmates and I designed and led a weeklong class through the "Upward Bound" program that introduced 14 high school students from marginalized backgrounds to hands-on biology research. It was amazing to see the kids' excitement as they collected insects, extracted DNA, and conducted their own experiments! I will continue to teach and improve this course every summer while I'm in graduate school.

I have a similar enthusiasm for my duties as a teaching assistant during the school year: after all, I first got interested in biology because of the wonderful teachers and great experiences I had in my introductory biology course. I believe that teaching, especially in undergraduate classes, is an often-neglected form of outreach. As a teacher, I'm able to support and encourage students who previously might not have thought this field was for them. For example, I have a student right now who adores coding and wants to pursue her interest farther. I know the feeling – I took a computational biology class in undergrad on a whim, and loved it so much that bioinformatics tools are now central to my research program. I introduced this student to github so that she can manage her coding projects and share them with others, and I'm keeping an eye on her in class so she knows she'll always have a helping hand if she needs it.

Moving from the classroom to the lab, I'm also trying to pay forward my good experiences by mentoring undergraduates in the Brisson lab to help them develop their research skills. This year, I'm mentoring two undergrads who are working on projects closely related to my own work, and I plan to involve several more undergraduate students in my planned research. When working with younger students, I try to emulate my own excellent mentors by striking a good balance between stepping forward to help my mentees when they're lost, and stepping back to let them try their own strengths when they're ready.

Encouraging younger people to pursue science isn't my only goal when it comes to building a strong scientific community; I also work hard to foster a supportive community among my peers. Peer teaching and mentoring is one part of this. For example, I'm very passionate about computational skills and have a lot of experience with the statistical programming language R. This past spring, I developed a series of R workshops in order to share my expertise. I've run the workshop series twice already for different labs in the department, and plan to continue offering it for anyone who's interested.

I'm also focusing on scientific community more directly through the lens of department climate. Alongside three faculty members from my department, I helped found a group called Women in Biological Sciences (WIBS) in order to support and advance the needs of female scientists in my department. WIBS meetings are open to all, allowing the group to serve a second purpose of educating people about the unique challenges faced by women and other minorities in the sciences through readings, presentations, and open discussion. I care deeply about good scientific community, and strive to ensure that people of diverse backgrounds feel welcome and at home in the sciences.

Summary

I am intent on doing high-quality research in an inclusive scientific community, with the ultimate goal of obtaining a tenure-track faculty position at an R1 institution. I am fascinated by integrative, evolutionary questions, and employ a wide range of methods to study these questions. My research, focusing on evolution of the female pea aphid polyphenism, builds upon my past experience and extends my interests in genetics, development, and environmental influences. This research is well suited to the Brisson lab and to the University of Rochester biology department. I give back to my department by building a supportive environment for my peers and colleagues, and pay it forward to the next generation of scientists through outreach.