Personal Background: I love answering questions. The process satiates my curiosity and causes my brain to fire on all cylinders, as I often explore creative solutions and draw from diverse intellectual fields to tackle difficult problems. I dream of having a career where I investigate question after question – the harder and more complicated the better. As a young child I fortuitously came upon what I believe to be the most interesting question in the world. I was born with a congenital heart defect, which, while having a relatively insignificant effect on my short and long-term health, brought my attention to the puzzle at the root of modern genetics. After reading a book about genetics at the age of twelve I realized the question at the core of my condition and the field of genetics were one and the same: "How do phenotypes arise from genotypes?" I strove to answer this question as an undergraduate, and I hope to keep answering it as a graduate student and eventually a researcher and teacher.

My journey to understand the relationship between genotypes and phenotypes made me an F_1 hybrid of the sciences and the humanities. I majored in both biology and philosophy to understand the techniques and theories of biology at a practical and conceptual level. To effectively communicate my research, I combined my passion for science with my previous experience in speech and debate to synthesize these skills into science communication that advocates for science to politicians and the public. Recognizing the importance of balancing the rigor and structure of science, I regularly performed improvisational comedy which fostered creativity and inspired dynamic communication and pedagogical techniques when I taught in the classroom. My experience beyond the sciences provided hybrid vigor in scientific environments and I believe have made me a stronger NSF-GRFP candidate.

Research Experience: *Phylogenetics and Genomics of the Order Brassicales:* In May 2013, I began working in Dr. Chris Pires' lab at the University of Missouri (MU). Over the following year I trained in bioinformatics and contributed to two phylogenetic projects. My contributions to those projects resulted in a published co-authored paper in PLOS ONE, and another co-authored manuscript in preparation. One of the most valuable parts of my first year was diving into the world of "big data." Before beginning research, I had little knowledge of genomes and only basic computational skills. Dr. Pires' lab opened up a new field of study and a new set of skills for me to master. I was enthralled by genomics and wanted to absorb all I could to apply these skills to my future investigations. I worked with a post-doctoral associate to assemble and analyze reference-based transcriptomes and taught myself basic programming skills with Perl, Python, and Bash. I have continually used the methods and conceptual framework of the genomics paradigm in my independent projects.

Metabolomics of the Order Brassicales: During Fall 2014, a new field, metabolomics, captured my fascination. I collaborated closely with a researcher from Stanford University on his project to analyze Brassicaceae species for anti-microbial and anti-carcinogenic metabolites. I was exposed to the new world of high-throughput analytical chemistry and witnessed the potential it held when combined with genomic methods. When my collaborator visited MU, we performed transcriptome and metabolome sampling. He identified novel compounds and found evidence of a metabolite in a lineage it had never been seen in before. This pilot study is being refined and the results are being prepared in a co-authored manuscript (in prep). During our weekly SKYPE meetings, I learned about the theory and application of analytical chemistry techniques and was excited about potential integrative and collaborative projects using these methods. Metabolic phenotypes presented the opportunity to tackle my deep conceptual questions about complex genotype-phenotype relationships, and the answers to my questions could be translated into useful antibiotics and nutritionally improved crops that could benefit society. I was motivated by this collaboration to combine genomics and metabolomics into a framework for answering questions in genetics.

Quantitative Genetics of Nutritionally Important Traits in Brassica rapa: Since spring 2014, I have been the primary researcher on a collaboration between MU, Dr. Michael Gore at Cornell University, and the USDA-PGRU in Geneva, NY. Working with Dr. Gore, who has a focus on crop biofortification, was a first-hand exposure to the societal benefits of integrating plant metabolomics, genomics, and breeding. I spent the summer of 2015 at Cornell University funded by the American Society of Plant Biologists Summer Undergraduate Research Fellowship and began a field trial for a genome-wide association study (GWAS) of nutritional traits in Brassica vegetables. While at Cornell, I gained field experience and expanded my genomics toolkit to include SNP calling and quantitative genetic techniques. This experiment was my first foray out of the greenhouse. Fieldwork excited me since I knew the results would be more representative of the real world compared to the controlled condition of the greenhouse. I crafted collaborations with researchers at University of California-Davis and the Donald Danforth Plant Science Center to produce leaf metabolomic and ionomic data. Currently, I am performing population genetic analysis on the sequence data and will complete a GWAS after receiving the nutritional trait data. These projects will result in two first author papers (in prep).

Systems biology and convergent evolution: Also during the summer of 2015, I co-authored a review article for the International Journal of Plant Science on convergent evolution and systems biology with colleagues at MU (in review). I was eager and thrilled to integrate philosophical questions about the origins and causes of convergence with my knowledge of genomics and systems biology techniques. I have long known that my work in philosophy of biology was useful, but this was my first time applying philosophical questions and analyses to strengthen biological investigations. Through this project I also familiarized myself with cutting-edge theory and techniques in systems biology and their application to studying complex genotype-phenotype relationships. Working on this paper solidified my motivation to understand convergent evolution and phenotypic plasticity using diverse techniques and theories.

Intellectual Merit: As an undergraduate at MU I crafted collaborations with university, private sector, and government researchers to conduct interdisciplinary work in the fields of phylogenetics, molecular evolution, and quantitative genetics. These projects challenged preconceptions in the field of phylogenetics, provided new information about metabolites in Brassicacae, and characterized molecular and phenotypic diversity in *Brassica rapa* at an unprecedented resolution. My work resulted in six manuscripts at various stages of publication and shows my ability to learn and integrate new fields into a focused research question. Furthermore, through these experiences I attained proficiency in a variety of research techniques that I will draw upon to complete my doctoral studies.

Broader Impacts/Outreach Experience: Education and communication have been a focal point of my undergraduate career. After enrolling in a science communication course as a sophomore, I gave a seminar about science communication at MU's *Saturday Morning Science* lecture series. That seminar confirmed my enthusiasm for communicating important scientific issues to the general public. After the lecture, I focused my philosophy education towards understanding the foundations of scientific practice and reasoning. I used my philosophical knowledge to contribute to dialogues surrounding climate change, evolution, and GM crops. I further honed my science communication skills my junior year with an MU fellowship funded by the Howard Hughes Medical Institute where I worked with a journalism student to produce blogs, videos, and magazine articles from May 2014 to July 2015. The biggest project was writing, filming, producing, and editing a video about the genetic and morphological variation in brassica vegetables that the Pires lab studies. To produce this video, I combined humor and creativity from improvisational comedy with narrative elements of my science communication training. The video has been used as a recruiting tool for the Pires lab and was highlighted on the American Society of Plant Biology and NSF iPlant websites. Later that year, I drew from these experiences to cut through jargon and focus on practical applications and societal benefits when I presented a poster to politicians at the Missouri State Capitol. I care about the representation of science in government and hope to motivate politicians to fund university science.

Through my experience in science communication and independent studies in philosophy I was offered two teaching assistantships. In these courses I seized the opportunity to integrate my experience in philosophy, science, and improvisational comedy to create and develop novel curricula. From my work in science communication, I became fascinated with the idea of narrative approaches for communicating science. When I helped teach “Finding the Story in Science,” I contributed to a novel final project where teams of science and journalism students shadowed the MU News Bureau as the bureau wrote press releases from MU research. Students obtained a first-hand experience with science journalism and watched as stories arose from the scientists' research. When I lectured in class about narrative storytelling I used exercises and techniques from improvisational comedy to increase student involvement and emphasize important points. Later, as a teaching assistant for “Philosophy of Science”, I helped design another innovative final project where students determined the contents of a sealed box without opening it. This project forced students to work as scientists and tackle my favorite philosophical problems, the nature of scientific explanation and discovery. Teaching deepened my understanding of philosophy and communication and revealed my fervor for educating students. I hope to use such dynamic pedagogical techniques as a graduate student and as a professor.

Academic goals, Professional Development, and Career Aspirations: Before graduate school, I hope to hone my experience in genetics and systems biology. I am enrolled in the Tuscon Plant Breeding Institute’s annual quantitative genetics workshop in January 2016 to become proficient in modern plant genetics theories and techniques. I am currently applying for a Fulbright fellowship to study computational systems biology at the University of Ghent in Belgium under Dr. Steven Maere, a collaborator with extensive knowledge of computational systems biology. The computational skills and experience I would gain would directly benefit my proposed metabolic modeling (see research statement). I would also gain an international perspective and lay the foundation for collaborations between the Pires, Gore, and Maere labs.

I plan to attend Cornell University to earn a Ph.D. with Dr. Michael Gore in the Plant Breeding and Genetics Section with minors in genomics and computational biology. While at Cornell, I will gain experience in quantitative genetics and use the techniques and framework of systems biology to enhance the results of quantitative genetic studies of plant nutritional traits. I also want to mentor undergraduate students in the Gore lab to contribute to their education in the same way graduate student mentors contributed to my development.

I aspire to become a professor at a major research university, and continue to use a combination of genetics and systems biology to investigate the complex processes underlying the genotype-to-phenotype map. My research will serve as the foundation for my undergraduate and graduate level courses that will focus on systems biology and bioinformatic techniques. I also want to expand upon my graduate student mentoring by building a lab that focuses on graduate and undergraduate student research development. Finally, I want to effectively communicate science to all audiences and inspire a new generation of scientists.