

Personal Statement

They say that when a young grey wolf—eager and uncertain upon its feet—sinks its incisors into the flesh of a North American elk for the first time, the young sapling stretches its grateful limbs skyward to embrace the flocks of rejoicing birds which come to nest among its branches. The beavers fashion sturdy dams of the grateful trees, where the otter families come to play. The bears abound and the coyotes tremble and the small rodents multiply in number. Even the Yellowstone River pays its dues to the howls of the canine predators, becoming more certain and fixed in its course.

Similarly, I believe that when a wide-eyed young explorer firmly plants the end of her knotted walking stick—dirty red bandana tied around the top—at the point where a small woodland creek diverges into two, an underrated high school honors biology teacher drops a beautifully-written book entitled “The Lives of a Cell: Notes of a Biology Watcher” by Lewis Thomas into the hands of a timid freshman student with a fire for knowledge in her soul. The seal to an acceptance letter for the College of Science clumsily slips through the shaking hands of a girl who dared to dream, and a few short months later, a shiny new backpack slips through those same fingers onto a beat-up old blue twin extra-long mattress at the University of Notre Dame. Tears of joy well up in the eyes of an overly-eager young researcher there, as the fluorescent red and blue glow of a perfectly executed 3D cell culture experiment announces that the fight with cancer is one small step closer to being won, and a sunbathing Northern Leopard Frog turns to assess the risk of the distinctive squish of approaching latex waders on the feet of a field biologist. And at last, a transformed and assured Notre Dame senior sits down to apply to graduate school.

So you see, the complexly interconnected nature of this beautifully dynamic planet generates consequences seemingly beyond the scope of everyday reason. This intriguing series of underlying cause and effect is what drove a young explorer in a red bandana, an overly-eager undergraduate researcher, a transformed Notre Dame senior to decide that a PhD in the natural sciences of this world was her surest path to fulfilment. When I began my undergraduate education at the University of Notre Dame, my eager and uncertain heart wanted to know something about everything. From Plato to Pasteur, the Big Bang to natural selection, I was primarily thirsty for knowledge above all else. I knew upon entering college that a life in scientific research was my ultimate career intent, but I was uncertain as to which sector of biology I was ready to devote my life over all the others. I therefore began a two-year period in which I explored and experienced every type of research I could—from introductory biology lab to genetics and genomics, microbiology to cancer research to environmental science.

The summer following my freshman year at Notre Dame, I maintained a job as a lab technician at Alliance Analytical Laboratory of Michigan, a microbiology and chemical analysis testing laboratory for the water, food, beverage, cosmetics, automotive and furniture industries. There, I experienced first-hand what it means to work both in industry and in a true laboratory setting. I primarily spent my time in the microbiology department, where I learned a significant amount about the life cycles, growth, and prevention of common microorganisms including *Escherichia coli*, *Salmonella senftenberg*, *Listeria monocytogenes*, *Lactobacillus*, and various yeast and mold species. I became intimately familiar with basic lab techniques and practices—from preparing samples to making and pouring agar plates to logging vast amounts of data to the critical importance of maintaining a precise and sanitized laboratory environment. By the end of the summer, I had discovered that the intricacies and specific lifecycles of microbiology were beyond fascinating to me, and certainly held potential as a path to which I could see myself dedicating my life, while additionally acknowledging that industry was probably not the environment in which I wished to continue as a career. With this revelation, I began to seriously investigate the possibility of earning a PhD over a MS, and entering the field of academia.

When I returned to Notre Dame for my sophomore year, I continued to explore the various areas of biology to which I could potentially decide to dedicate my life. After a semester spent in a genetics lab on my first true independent research project, genetically isolating and cloning a novel retinal degeneration allele in *Drosophila melanogaster*, I knew that I had finally eased myself into laboratory environments enough: I was ready to begin in the world of research itself. I spent the next semester in Zachary Schafer's cellular biology lab, studying the effects of Epidermal Growth Factor Receptor (EGFR) in potentially overcoming the barriers to cells typically associated with detachment from the ECM. EGFR overexpression was found, through a series of assays, to increase both glucose uptake and ATP levels in cells, in addition to decreasing both ROS levels and caspase 3/7 activity. EGFR overexpression alone was additionally found to promote luminal filling in 3D cell culture grown in Matrigel, and an inhibition experiment was then performed in order to begin to localize the effects of EGFR to a specific cellular signaling pathway. Results suggested that EGFR works independently of the PI(3)K pathway. At the end of the semester, I presented a poster titled *The Role of EGFR in Overcoming Anoikis and Promoting Metabolic Maintenance in ECM-detached Cells*, and was awarded the Braco Award for Excellence in Cell Biology Research for my findings.

The subsequent summer, I was accepted to a competitive research program at the University of Notre Dame Environmental Research Center (UNDERC) in Northern Wisconsin and was awarded a \$3,500 stipend in addition to research funds for 10-weeks of summer research through the Bernard J. Hank Family Endowment Fund. There, I initiated a study regarding the means through which six different closely-related species, all of the genus *Rana*, might be effectively partitioning their resources in order to successfully coexist in proximity in the North Woods. My study identified several distinct behavioral preferences among the species, both in habitat selection and foraging behavior, and could potentially be used not only as a basis for further study of *Rana* species, but as a model system for investigating the means through which any number of different closely related species might be surviving in proximity through behavioral differentiation. Because the ability of closely related species to live in proximity to each other is essential to maintaining a high degree of biodiversity in an area, a thorough understanding—through projects such as this one—of the means through which this occurs is essential to an understanding of biodiversity and how to help maintain it in today's world. At the end of the summer, I both presented my findings and finished my paper, titled *Behavioral Resource Partitioning among Rana Species in Northern Wisconsin*.

Additionally, my time spent on this project concluded my two-year discernment process; by the end of the summer, I knew without a doubt that I would dedicate my career to environmental studies such as this one. With this decision made, I committed to an undergraduate research position at the University of Notre Dame in Elizabeth Archie's lab for behavioral and disease ecology the next semester, which I maintained for the remainder of my undergraduate career. The Archie Lab investigates how social behavior and organization affects the health of social mammals through closely tracking the health of a population of baboons living in the Amboseli Ecosystem in Kenya. Ultimately, we hope to learn more about the close-knit relationship between the baboon microbiome and social hierarchy—and the dual direction of unexpected influences that these might have on each other.

During the summer before my final year at Notre Dame, I was yet again accepted to the competitive University of Notre Dame Environmental Research Center program and awarded a \$3,500 stipend in addition to research funds for another 10-weeks of summer research, this time on the National Bison Range in Western Montana. There, I investigated the potential impacts of native vs. introduced grazing as a conduit for invasive species into the Palouse prairies of Montana, and the subsequent trophic effects of these species on soil nitrogen content.

As I have learned throughout my time I undergraduate research, a trophic cascade is, by definition, far-reaching and unpredictable. Its complex nature and subtle logic also make it, in my opinion, one of the most fascinating concepts in the entire world. I could not pin-point for you the exact moment that I decided I wanted to pursue a PhD in biology. All that I could tell you for sure is that retrospective analysis certainly indicates a trophic cascade of sorts of my very own, leading me here, to this point: on the brink of deciding which graduate program should propel me into my future. As with any retrospective analysis, one could of course point out to you the signs, subtle or overlooked at first, but painfully obvious upon the collection of further data. The need for novelty, above all else, of a young explorer. The burning desire for knowledge of a timid freshman. And the tears of joy of an eager young undergraduate researcher when she saw for the first time the answer to a question to which no one else in the world knew. I enjoy doing research because there is nothing more compelling to me than the idea of learning beyond the scope of a textbook—of collaborating with the larger scientific community to put forth information never before known, information which might one day change the curriculum in textbooks themselves. I love *dynamic* science, not stagnant science. I love asking questions, drawing connections, understanding implications, making predictions. And these are the variables which have led me here—with a wide variety of research experience, a passion for science, and a determination to succeed—ready to extend my own cascade beyond myself: to push forth future students, to answer questions this world has not yet thought to ask, and above all else to identify the underlying connection and reason to the natural world around me.