

April 30, 2020

### **Self-Reflection Essay: Capstone Project**

My experiences working on this capstone project are among the most formative I have had in my time as an undergraduate student at the University of Cincinnati. In the two semesters I have spent researching tick questing behavior with Dr. Joshua Benoit and Dr. Kennen Oyen, I have learned much regarding experimental design, data analysis, and working in a professional scientific environment. It has also expanded my professional interests in the sciences. The lessons I have learned through this project have undoubtedly left me better prepared for the challenges that await me in the future.

Many of the classes I have taken have a laboratory component. Generally, they revolve around replicating experiments so that we can better engage in the subject material. While the research I was assigned to was based on earlier work done by Dr. Benoit's research team, the intention was to expand on some of their findings. I was tasked with evaluating the impact of dehydration and starvation on *Dermacentor variabilis*, the American dog tick. As the number of vector-borne disease cases increased threefold from 2004-2016 (Centers for Disease Control and Prevention, 2018), researching the questing behavior of this parasitic arthropod is an important and necessary measure in protecting lives.

While excited to start the research, I was also nervous. I feared somehow bungling the experiment or compromising the results. Furthermore, I was working for a prominent and prolific research team and wanted to meet their standards. These nerves dissipated upon better getting to know my supervisor, Dr. Oyen. Her helpfulness and reassuring words made it much easier for me to

adjust to this new environment. She worked with me every step of the way for this experiment, from its configuration to its analysis.

After the initial setup, we had the task of creating a system for quantifying and documenting tick behavior. This was, for me, the most difficult part of conducting this research. Our original approach involved a complicated system of categorization, as we hoped to capture as much data as possible. Unfortunately, it became apparent that this method was unrealistic, given the number of ticks and their frequent doings. We ultimately decided it would be best to focus primarily on measuring the time to quest, as this was the variable we were primarily concerned with. I would record the other observations at my own discretion. At the outset, handling the ticks (which were often active and aggressive) was daunting. Nevertheless, as the research progressed, so did my ability in dealing with these parasites. After this initial troubleshooting, the daily procedures for the experiment went smoothly.

From November 2019 to March 2020, one hundred and eighty ticks were accessed in sixty separate trials, although roughly half of the measured ticks did not participate in the trial, which limited the usefulness of much of the data. As the Spring semester progressed, our focus began to switch from research to analysis. Dr. Oyen was instrumental in this process, using R to quickly generate p-values and figures. It was determined that neither variable was statistically significant. However, the results did strongly suggest that starved individuals quested more quickly. It also found that dehydrated ticks, on average, quested slightly faster than hydrated ones. Despite having marginal p-values, these results appear to be in line with recent discoveries regarding the metabolic, physiological, and transcriptomic impacts of prolonged tick starvation (Andrew Rosendale, 2018). While these results were encouraging, more testing would be needed if we were to fully determine the influence of these variables on questing behavior.

While I was pleased with the pace made on data collection, I felt there were ways in which the procedure could be improved for the following semester. Many of the ticks in the un-starved group were in poor health: several were missing limbs, impairing their mobility. To account for this, we devised a simple, effective method for recording which legs were missing on each tick. That way, the time differences in questing due to deformity or injury were accounted for. In hindsight, it also seemed worthwhile to measure the number of times each tick attempted to escape its arena, as this behavior was common yet distinct to only some of the population.

Unfortunately, the next phase of the project was truncated due to the COVID-19 pandemic. Had the semester continued as planned, we would have likely had about twice as much data to analyze. This obstacle almost certainly impacted the outcome of our analysis, as we were limited to approximately fifty ticks per treatment group. Had there been more data, we could have more definitively accessed the significance of starvation and dehydration on time to quest. Instead, the information presented in my capstone is the data from the aforementioned meeting.

While it saddens me to have this research cut short by the Coronavirus, I am immensely grateful for the opportunities and experiences afforded to me by Dr. Benoit and Dr. Oyen. I have learned a great deal regarding the behavior and physiology of *Dermacentor variabilis*. Furthermore, I better understand how to design and conduct experiments. I have also noticed a substantial improvement in my observational and technical skills in the laboratory. Additionally, this project has expanded my appreciation and interest in both animal biology and behavioral science. No matter what direction I take with my life after graduation, I am wholly confident that what I have learned here has left me better prepared for the future.

## References

- Andrew Rosendale, M. D. (2018, November 18). *Progressive behavioral, physiological, and transcriptomic shifts over the course of prolonged starvation in ticks*. Retrieved 4 30, 2020, from Wiley Online Library: <https://onlinelibrary.wiley.com/doi/abs/10.1111/mec.14949>
- Centers for Disease Control and Prevention. (2018, May 1). *Illnesses on the rise*. Retrieved 4 30, 2020, from <https://www.cdc.gov/vitalsigns/vector-borne/index.html>