My career in research has thus far been a process of gathering new knowledge, new confidence, and exploring different areas of interest to determine which specialty will suit me best in my future education and career.

For two years I worked as an undergraduate research fellow with the National Science Foundation (NSF) sponsored math-bio research fellowship (funded by NSF grant #0634182) at the University of North Carolina Greensboro (UNCG). Our fellowship group consisted of small teams of students working on different projects but meeting several times a week to report and discuss findings. My research group was focused on building a game theoretic model of a kleptoparasitic (stealing) population or individual. As the only biology student in our group I was responsible for all of the initial background research involved in choosing our study organism. I was also responsible for choosing relevant life-history and ecological parameters to include in our model. During this primary research I discovered there was a beetle, *Onthophagus taurus,* with sustained populations in North Carolina which shows evidence of kleptoparasitic behavior (Moczek and Cochrane 2006). Our group agreed this was the ideal organism for our model. Using parameters developed from my research, our group (though primarily the math majors) worked together to build our model. After the completion of our model, my biology mentor and I set up a series of behavioral experiments to test the predictions the model made. During one research season each year we collected beetles and developed field (density, abiotic factors) and lab protocols (video analysis for timing of behaviors, mate pairing to determine fecundity in situations with and without kleptoparasitsm) to test our hypotheses. The early experiments gave us greater understanding of the behavior, which we used to add and subtract certain parameters from the model. Upon several revisions we came to a final model in the fall of 2008 which we submitted to the Journal of Evolutionary Ecology (M. Crowe *et al* 2009). This was the first deterministic model of kleptoparasitism using a specified living species (as opposed to a purely theoretical approach) ever developed.

During my time in the math-bio fellowship I developed my presentation skills by giving oral and poster presentations at 18 conferences, the most prestigious of these being the international conference for mathematical models in evolution and ecology (MMEE) at the University of Sussex in September 2007, and the annual meeting of the Animal Behaviour Society, held at Snowbird, Utah, in August 2008. Sharing my research with others and listening to presentations of their work gave me confidence in my ability as a young researcher and affirmed my plans to continue my education after finishing my bachelor's degree.

At the end of my fellowship I knew that I enjoyed research and that I wanted to continue to study biology, but I didn't have a firm idea of the specific area of graduate research I was interested in. I loved working with stealing behavior, but felt that I needed to explore other areas as well, before I committed to one system. I also wanted to test my modeling skills and determine if mathematical biology was a consideration, so I applied and was accepted as a undergraduate research assistant in the mathematics department of UNCG. Concurrently, I began to apply to research experience for undergraduate programs (REUs) for the summer of 2009 because I had an interest in ecological research and wanted a purely biological field experience.

I enjoyed the process of modeling to an extent that I wanted to solidify my knowledge in this area while I had the opportunity to work with my gifted mentors at UNCG. During the past year, as part of an undergraduate research assistantship, I built a new model of kleptoparasitic behavior independently while my mathematics mentor, Dr. Jan Rychtar, supervised. At the same time, I worked with Dr. Rychtar and Dr. Graeme Ruxton (University of Glasgow) using previous biological research to create a general model and overview of kleptoparasitic behavior. Through

both projects I will be submitting papers for publication and giving several presentations in the coming months. These largely independent projects were the next logical step for me to enhance the knowledge I gained in my fellowship, to challenge myself, and to continue to explore the aspects of research (and stealing behavior) that I enjoy.

My search for an REU program was also extremely successful. In the spring of 2009 I was given the opportunity to spend the summer in Costa Rica through the organization for Tropical Studies (OTS) REU program in 2009. My research involved a microhabitat and population study of a species of wren, *Henicorhina leucostica. H. leucostica* is one of the few species of understory insectivores with an increasing abundance in Central America; most other species have been found to be in severe decline since the 1970s (J. Hurtado *pers. comm.)*. Because of their relatively high abundance, and apparent preference for disturbed forest, *Henicorhina* was a perfect study organism for a comparison of old- and new- growth forest types. The OTS program required REUs to develop a complete proposal presentation and paper previous to our summer research, as well as a final report and presentation of our findings at the conclusion of the program. I worked with my mentors to develop hypotheses, field protocols, and used an advanced statistical method (a principle components analysis with SAS statistical software [SAS inc. Cary, NC]) to analyze data. Data collection included over 27 microhabitat variables as well as bird point counts of *Henicorhina* and two competing species. Previous to this experience I had never had the opportunity to immerse myself in research so thoroughly, or spend so much time with similarly minded scientists. I learned much about the foundations of ecological and tropical research, as well as specifics about what my primary interests are.

I choose this particular program and project because I wanted to do something outside of research in the field I had already studied (behavioral-mathematical biology). I wanted to be certain that I came to graduate school with a well-rounded opinion of the topics that interest me. In this way the program gave me exactly what I had hoped. I thoroughly enjoyed working with birds and developed a real interest in ecology as a specialty. I also found that behavior research excites me in a way the habitat analysis does not, and while birds are an amazing study group, I find insects more enticing. Birding has become a new hobby that I thoroughly enjoy, and the new analysis techniques and style of approaching a problem are skills that will greatly enhance my future research; while working in a new field help me to reaffirm that my interests lie primarily in behavioral ecology and that I want to work in kleptoparasite research in the future.

As my undergraduate career comes to a close, I am certain that I have taken every opportunity to explore the various aspects of research that interest me. My experiences have taught me the frustrations and joy that come from in learning new material, working with novel systems, and working in a rugged environment. Often I've found that in research, you don't always find what you hoped, but in the process of looking for it, you learn more than you ever could have expected. Based on my previous experience I know my graduate studies will be challenging and exciting, boring and frustrating, life changing and life affirming, and I am looking forward to every minute of it.

Citations

Crowe, M., M. Fitzgerald*, D. Remington, G. Ruxton, and J. Rychtar J. 2009. A Game theoretic model of brood parasitism in a dung beetle *Onthophagus taurus*. *Evolutionary Ecology* 23(5):765-776

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