

Biological Research plus Mathematical Modeling: an Equation with only Positive Solutions

Many young researchers who plan to continue to work in biology are unaware of the interdependence that exists between biology and mathematics. We're biologists! We didn't choose this field to deal with numbers! Yet, as we develop our skills it quickly becomes apparent to us that this is exactly what we are expected to do in order to make our data usable, relevant, and publishable. This interdisciplinary experience is just what I am looking forward to as I approach my graduate education and future career as an academic researcher.

The need for synergy between mathematics and biology is not a new proposition. There are many programs devoted to promoting the interplay between the two fields. Some of these are federally funded programs, such as the math-bio fellowship program I was involved with for two years at the University of North Carolina Greensboro (UNCG), graduate programs devoted to mathematical biology, and scholarly journals promoting knowledge growth at the interface of biology and mathematics. However, my proposed plan for adapting this in my graduate study is unique. My approach to bridging the gap between biological and mathematical research doesn't include studying mathematical biology, or becoming a mathematician myself. Instead I choose to work with what I've learned, what I enjoy, and in an area where my strengths are best taken advantage of: research in behavioral ecology, with an element of outreach to the non-scientific community, in an environment that strives for open-minded exchange between disciplines.

I found the classes I've taken in animal behavior, ecology, and symbiosis to be mind-opening and incredibly exciting. Whether we were discussing the relationship between Giant Squid and their bioluminescent symbionts or learning about parental care in mouth-breeding cichlids, I couldn't (and still can't) get enough information to completely satisfy my curiosity. The grades I received in these classes reflected my interest as well as my understanding of these subjects, however, I don't believe that coursework alone could have completely opened up the biological world to me in the way that my field experiences did. I received an amazing opportunity this past summer to participate in an undergraduate research experience in the wet tropical rain forest of Costa Rica through the Organization for Tropical Studies (OTS). This experience is what cemented my interest in behavioral ecology. During my first weeks at the OTS-La Selva Biological Station it seemed as though everything I saw was a demonstration of my ecology textbook come to life: leks of manikins, leaf-cutter ants, and oropendulas greeted me every time I stepped outside. I was overwhelmed and excited about spending all my days studying and absorbing the beautiful landscape that surrounded me. As the summer progressed, the overwhelming nature of the tropical forest subsided somewhat, but my interest in the interactions going on all around me did not. I feel incredibly fortunate to be able to work in a field that I enjoy so thoroughly, and know with certainty that in choosing to study behavioral ecology, I will be able to pursue a career that I have a natural aptitude for and that I love waking up to every morning.

As a graduate student I am hopeful that I can continue to be an advocate for behavioral, ecological, and interdisciplinary study through outreach to the greater community of grade and high school students and educators and through my relationships with my mentors and colleagues. Previous to my undergraduate degree I worked for many years with underrepresented children in educational and recreational settings. Due to this, I have a firm understanding of the enthusiasm and excitement necessary to bring the sciences to these out-groups and I believe I can bring my research to life for young people still debating what they would like to study if or when they reach college. My strong background in presentations and publications has given me the experience of sharing my work with others, as well as the skills

necessary to work in an outreach setting, a component of my further education and career that I consider essential.

In addition, an important aspect of sharing research within the community (both scientific and non) is the flow of ideas generated by open discussion. My participation in the aforementioned math-bio research fellowship (2007-2008) was my first foray into mathematical biology. Because our group members consisted of students from various science fields (mathematics, physics, biology) we needed to explain the work we did to each other in order to cover any unknown background information. As the depth of our research grew, we began to realize how much new knowledge is formed simply by listening to a different point of view. Rather than the typical questions asked by a biology student, the math students came to our meetings with new questions, and new methods of finding the answers. This increased the depth of my knowledge of biology, the mathematics involved in the model we were forming, and most importantly why we used both approaches.

As I speak to professors about their labs and the research I plan to do in graduate study, my first consideration is the type of lab environment I will be working in for my doctoral work. I am looking for a cooperative approach to science, similar to my fellowship experience, which promotes an environment of discourse and collaboration. In addition, I intend to keep lines of communication open between my current mathematics faculty, the students I have worked with, as well as future mentors and lab mates, and myself, and in doing so I will continue to build a network of people who have the same excitement and commitment among the various branches of the sciences, as well as to the community as a whole. In this way, I will use what I have learned about working with mathematicians and carry on increasing my knowledge of biological systems in a way that further insures my success in graduate study and my career objectives

My experiences as an undergraduate have helped me to understand and appreciate the work a behavioral ecologist can do. In addition, through my experiences I've even come to appreciate and love mathematics, something I would not have thought possible previously. I have progressed to a point where my knowledge of mathematics enhances the work I do, even when I am not using modeling specifically. I may not ever have a "mathematical mind," but at least I now know how to speak the language. I believe that in an increasingly interconnected world, all scientists can benefit from broadening their perspectives and engaging in interdisciplinary research and both the scientific community and those outside of it can benefit from an increase in communication and idea-flow within the sciences and with the general public.

In searching for a graduate program that will best fit my needs, as well as while considering my career objectives, I have focused on programs with a strong interplay between lab members, those that have, or are willing to allow me to implement, an active outreach program, and those that consider my background in mathematical biology an asset. I have no doubt as to my abilities to succeed and thrive in a doctoral program of this nature, as well as my ability to enjoy a long future of academic research. All of my years of hard work and past experiences have led me to this point and I can't wait to get started! With the Graduate Research Fellowship I will be able to devote all of my time to research, collaboration, and outreach and allow my goals to reach further than would be possible otherwise. I greatly appreciate the resources available through the National Science Foundation for students like me, with clear, well researched objectives and hope for a future of scientific discovery ahead of them. Thank you so much for your consideration.