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Beckman Scholar 2006-07

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Research Experience Prior to Beckman
I started the University of Kentucky declared as majoring in Agricultural Biotechnology, because I thought I wanted to be a vet, and the Agricultural Biotechnology major was much more rigorous and much more flexible than an animal sciences degree. I first decided to give research a try the summer after my freshman year at UK. I was looking for a summer job that would look good on my résumé, and I remembered that I would need to find a mentor for my ABT 395 (Independent Research) project my junior year. I went to my then advisor, Dr. Glenn Collins, and he helped me find a job in Dr. Christopher Schardl’s lab. I was immediately immersed in the research process on a project studying the phylogenetics of many different fungal isolates from various grass species.

During that first summer I learned how to go from grass material to fungal culture, how to isolate fungal DNA, and run PCRs (polymerase chain reactions) and sequencing reactions of the DNA I had extracted. I found it rewarding that I could take a piece of grass and end up with a DNA sequence from the fungus inside, all on my own. After that first summer I was sure that I wanted to go into research instead of becoming a vet because it was something I was good at and I found that I really enjoyed the problem-solving nature of lab work. I continued working in Dr. Schardl’s lab during my sophomore year, and I became skilled at balancing work with school because I decided to continue working in Dr. Schardl’s lab during the academic year.

The Beckman Scholarship
I applied for the Beckman scholarship in the spring of my junior year, and was ecstatic when all the long hours working on my proposal paid off and I received the scholarship. This scholarship has allowed me to focus on my research without worrying about a second job. Also, along with the monetary benefits of the Beckman, I was able to attend the Beckman Scholars Conference last summer, where I was able to see presentations on cutting edge research in diverse fields including stem cell research and solar power. This conference was one of the most rewarding experiences of my life, because it was attended by professors at the top of their fields from all over the nation, as well as other Beckman Scholars. I was able to make many friends there, and am impatiently waiting for the conference again this summer, when I get to present my research.

Another benefit of the Beckman Scholarship is that it has provided the funds and support necessary for me to attend and present at several conferences other than the Beckman conferences. This spring I presented at NCUR (the National Conference for Undergraduate Researchers) at Dominican University in San Rafael, CA. This was also a great opportunity to meet other...
students interested in research and a great place for me to be able to share my own research. I also presented at the Showcase of Undergraduate Scholars here at UK, a wonderful experience I recommend to any UK undergraduate researchers. This summer, along with the Beckman Scholars conference, I am excited to be able to attend and present at the American Phytopathological Society (APS) meeting. This meeting will be an excellent place for networking as well as a great place to learn about what is currently happening in my field, Plant Pathology. I don’t think that I would have been able to attend any of these conferences without the support of the Beckman Scholarship.

Future Plans
I graduated this spring from UK with a BS in Agricultural Biotechnology and a minor in Plant and Soil Science. I will be attending my first choice graduate school, North Carolina State University, in the fall in their Ph.D. program in Plant Pathology, one of the top Plant Pathology Programs in the nation. This summer, before I go to graduate school, I will be finishing up my Beckman research project in Dr. Schardl’s lab.

I think that undergraduate research is a wonderful experience that I would recommend to any student who is at all interested in research. I have loved working in both the labs I have been in, and think that it is a great learning opportunity. Also, my research experience together with the Beckman Scholarship made it much easier to get into a top graduate school.

My Research
The following is an abstract for the research I am still working on as my project for my Beckman Scholarship:

Ergopeptine alkaloids are peptide mycotoxins that are produced by many different species of fungus, including various grass endophytes such as Neotyphodium coenophialum, and several grass pathogens, such as Claviceps purpurea. They are important for their pharmaceutical properties as well as their toxicity to humans and livestock. They are synthesized from D-lysergic acid by a lysergyl peptide synthetase made up of two polypeptides, LPS1 and LPS2. Variations in the 3 modules of the LPS1 protein are responsible for which 3 amino acids are bound to the D-lysergic acid in ergopeptine alkaloid synthesis. These three modules also contain three domains: A, T and C. The A domain is the domain responsible for recognizing the next amino acid to be bound. The gene responsible for encoding the LPS1 in Neotyphodium coenophialum, which produces ergovaline, is known to be the lpsA gene. Claviceps purpurea, which produces both ergotamine and ergocryptine, has two genes, lpsA1 and lpsA2 that encode two different versions of LPS1.

We have characterized a cluster of ergot alkaloid biosynthesis genes in this strain that includes 2 homologues lpsA1 and lpsA2. We determined the order and orientation of these genes, and identified regions of sequence identity and dissimilarity between lpsA1 and lpsA2. We are now transforming lpsA-minus endophytes with clones of lpsA1 and lpsA2 to determine which gene in C. purpurea is responsible for the production of which ergopeptine. We are also investigating whether recombination between lpsA genes in C. purpurea contributes to the diversity of ergopeptines produced by different strains of this fungus. We also plan on recombining the lpsA genes to determine if the three modules encoded by the genes act independently. This possibility will be tested by switching the first module from one LPS1-encoding gene with the first module from a different LPS1-encoding gene, which will result in the production of a different LPS1, and therefore a different ergopeptine, if our hypothesis is correct.