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Research: My Undergraduate Journey

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I recently graduated Summa Cum Laude with a 4.0 GPA from UK, receiving a Bachelor of Arts degree in Chemistry with a minor in English and a Bachelor of Science degree in Biology. I graduated with Honors in Chemistry, Biology, and Honors. I am a National Merit Scholar and a Beckman Scholar.

I plan to attend medical school at the University of Cincinnati. However, I am deferring my admission for a year to teach at a mission high school in rural Jamaica. I will also be volunteering in the local medical clinic and working on a novel. After medical school, I am interested in pursuing a career in pediatric oncology and becoming more involved as a medical volunteer both nationally and internationally. At any level of medicine, I think it is important to have a foundation in the basic sciences, and I feel very confident that I will carry the foundation my research at UK has established throughout my career and, hopefully, have an opportunity to pursue clinical research.

My research with Dr. Allan Butterfield in the UK Chemistry Department examines oxidative stress in Alzheimer's disease and explores the mechanisms of neurodegeneration in this mentally debilitating disease that plagues the aging population. As more research is conducted as to how Alzheimer's disease occurs, more research can explore treatment and prevention options.

I enjoy traveling, hiking, reading, writing, and theater, among other things. I am very good at having more to do than I can possibly accomplish each day, and I am always finding new interests and hobbies.

While at UK, I participated in the Journal Project with the Honors Program and also studied for a semester in England. I played club volleyball for several years, multiple intramural sports, and wrote for the *Kentucky Kernel*. I also volunteered at the UK Children's Hospital and for Jarrett's Joy Cart. Throughout my four years, I was very involved with the Catholic Newman Center, acting as a student leader, retreat coordinator, and trip coordinator for such things as spring break service trips and World Youth Day. I taught religious education and was also active on the Newman Foundation Board.

I look forward to my life beyond UK, but I know I will always have a home here, because UK has helped me to grow so much as a person and to realize some of my ambitions.



Mentor:
Dr. D. Allan Butterfield,
Professor,
Department of Chemistry

Alzheimer's disease (AD) is the major dementing disorder of the elderly. Through NIH-funded research, our laboratory has proposed a model of neurodegeneration in AD brains stemming from the oxidative stress associated with a peptide (ABeta) that accumulates in the brains of AD patients. As an undergraduate, Robin has contributed to this effort by studying oxidative modifications of histones, those proteins that bind to DNA in the nucleus, caused by the lipid peroxidation product, HNE (itself formed from the action of ABeta). Robin has also investigated oxidative stress in brains from rodents with a mutation that models AD. This research presents a multitude of future research opportunities to gain insight into the molecular basis, treatment, and/or modulation of this devastating dementing disorder.



Research: My Undergraduate Journey

I knew from my junior year of high school, when I first visited the University of Kentucky, that I wanted to be involved with research during my junior and senior years of college. I had never realized that undergraduates were permitted to help in research; wasn't that illegal or something? It sounded interesting. Not only was it permissible, but also highly recommended by the Chemistry and Biology departments for students to participate in undergraduate research. At that point, I didn't really know what serious academic research meant; the most experience I had in a lab was dissecting a dogfish in my high school marine biology class. My lab partner and I used to fight over the scalpel. I relished the idea of more power (oh, and responsibility, too, I suppose) in the lab and the potential to cure cancer while I was still an undergraduate. I could move on to AIDS once I graduated. I was young. I was idealistic. I was rather silly.

Then, I moved upwards to the exhilarating world of . . . freshman chemistry lab. Research interests drifted into some oblivion of future classes, for when I was older and wiser and knew how to properly operate a beaker and a pipet. Like those around me in required courses, I became more concerned with doing the work for a decent grade than learning lab principles I could implement as a researcher. Each course, though, granted me a bit more freedom and a bit more responsibility; I grew more confident and interested in academic research.

When the time came at the end of my sophomore year to choose a research mentor, I perused the research interests of the Chemistry faculty. I was amazed by the range of the research going on in laboratories I walked by every day. What a plethora of opportunities! Just as I was preparing for a deciding round of "Eenie Meenie Miney Moe," I returned to the description given by Dr.

Allan Butterfield. Alzheimer's disease research, huh? I knew I wanted to go into medicine, and I knew Alzheimer's disease was an absolutely horrendous disease plaguing the global population. I didn't know much more than that, though, and I felt that I should. I really felt a desire to expand my knowledge in the area, and his research sounded fascinating.

I communicated my interests via e-mail as early as I could. I would be studying abroad in the fall, but I knew I wanted to work with Dr. Butterfield when I returned from England for the spring semester and all throughout my senior year. I had learned from a summer research position at Children's Hospital in Cincinnati that getting results in three months is very difficult, and I was ready to put forth my full efforts as a researcher. As soon as I returned to UK, eager and anxious to begin, I e-mailed Dr. Butterfield. He invited me to join his lab meeting that same day.

Most of my first semester of research was spent learning the procedures used in the lab. I think I learned more that first semester of research than in any single laboratory course I had taken; I was able to witness the application of my education thus far. I find that education is much more compelling when you can apply it to a real situation. I wanted to learn the current research in Alzheimer's disease in order to better understand my own research.

That spring, I was given a wonderful opportunity. The University had recently been granted the privilege by the Beckman Foundation to award six Beckman Scholarships over the course of three years for undergraduate research in chemistry, biochemistry, and the biological and medical sciences. A prestigious national award given to such schools as Duke, UCLA, and Boston University that same year, Dr. Butterfield and the UK Chemistry department strongly encouraged me to apply for the Beckman Scholarship. With their support, I was able to present my research proposal for studying models of Alzheimer's disease and really step into a serious researching role.

The Beckman Scholarship not only provided me with the financial support to continue my research over the summer and following year, but it also boosted my confidence. When I began exploring the idea of researching as an undergraduate, I figured I would be washing dishes for two years and just observing the real research. Here was an opportunity to conduct my own studies in which I had the encouragement of professors, mentors, and the University community in general. Granted, the opportunity appeared a bit daunting at first, but the challenge has stimulated my growth as a student, a researcher, and a person.

I worked full-time in the lab over the summer and part-time during the school year, and I began to

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make some progress with my research. Dr. Butterfield and the graduate students in the lab treated me like a graduate student. With that faith and respect instilled in me, I was able to move about the lab confidently. I think it is very important as an undergraduate researcher not just to learn by experience, but to take the experience into one's own hands and not merely follow in the footsteps of another researcher. Being treated as an equal propels you to work as an equal as well.

One of the most exciting aspects of my experience as a Beckman Scholar has been the opportunity to share my research in a professional setting. National scientific meetings like the Society for Neuroscience conference I attended in Orlando, FL, last fall are certainly eye-opening. A convention of ideas and discovery, these conferences are absolutely packed with scientists from around the world bringing their research together. The scientific world extends so far beyond the laboratory!

Before stepping into the role of researcher, the term "poster" meant an advertisement for the latest movie or something you colored on with markers. At the American Chemical Society conference in New Orleans this spring, I presented a scientific "poster." I learned that posters are just another medium for presenting research, a large sheet of paper on which a researcher can present the essence of his/her research. Other scientists can walk around a room full of posters, looking at various ones to gather insight into the latest research or talk with the researchers about similar studies they might have ongoing in their own laboratory. It's a remarkably efficient process for spreading knowledge and ideas.

It's also remarkably fulfilling. The first person to look at my poster in New Orleans was enthralled by my research as an undergraduate. Her mother had died from Alzheimer's disease, she told me, and she was constantly looking for new advances in the field. She had such passion, and it really infused me with energy; it reminded me of the importance of what I am doing in the lab, as well as the responsibility. Finding a cure for something doesn't happen as quickly as I used to think in high school. It takes the time and dedication that my experience as an undergraduate researcher has taught me. It also takes energy, and that energy, more than anything else, is what my experience has taught me, an energy that will continue to inspire me as I move away from the University of Kentucky and into a graduate and professional realm.

The article that follows provides some scientific background for the research on Alzheimer's disease in which I have been engaged over the last two years in Dr. Butterfield's laboratory.