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Laura Crawford: A Beckman Research Experience

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Like the majority of college freshmen, I was unsure of my career path. I liked science, and the possibility of contributing to new knowledge interested me. Exploring a research career seemed like the natural next step, and I began working in the lab of Dr. Greg Gerhardt my freshmen year. I studied how the resting levels of glutamate, a neurotransmitter, were altered in rats with traumatic brain injuries, and I recorded the glutamate levels using novel microelectrode technology. During my time in the Gerhardt lab, I became more interested in research and began thinking about a research career in the biomedical sciences. Around the same time, I began shadowing a local neurologist, and while I loved many aspects of patient care, I became frustrated that he could not provide positive outcomes for many patients suffering from varying neurodegenerative diseases and traumatic injuries. I was inspired by my mentor's compassion for his patients and his devoted care. I decided that I wanted to be a doctor like him someday, but that I also wanted to contribute to a growing body of research that could potentially help thousands of individuals suffering from these terrible illnesses.

After deciding to pursue a research career, I applied for the Arnold Beckman Scholarship. I began working under Dr. Diane Snow, which allowed me to stay in neuroscience and gave me the opportunity to receive guidance from a female mentor. I was granted the Beckman scholarship in April 2009, which provided me with financial support for my work in the Snow lab until Summer 2010. For my project, titled "A Novel Methodology to Identify Chondroitin Sulfate Proteoglycan Microstructures that Inhibit Neuronal Regeneration," I hypothesized that the identification and subsequent removal of the most inhibitory components of chondroitin sulfate proteoglycans (CSPGs) through selective modification would promote regeneration after spinal cord injury. We also proposed that the characteristics that are responsible for CSPG heterogeneity, glycosaminoglycan (GAG) chain number and length and sulfation pattern and extent, are closely linked to inhibition level. Thus, my study aimed to first identify and later, selectively modify CSPG structure to target the most inhibitory components of the molecule, while simultaneously preserving the benefits of the glial scar and its CSPG upregulation after spinal cord injury.

The results of my study demonstrated that varying the chemical substructure of aggrecan, a CSPG, dramatically changes the neuronal response, ranging from being completely inhibitory to almost completely permissive to growth. The data supports the hypothesis that the characteristics that make CSPGs heterogeneous, GAG chain length, number, and sulfation pattern and extent, are closely linked to the level of neuronal growth inhibition. The data also supports that after identification of the inhibitory chemical substructure of CSPGs, modification of this component would promote neuronal regeneration after spinal cord injury. The following summer, I worked to further characterize the binding of our CSPG variants to their substratum. The binding assay that I developed will allow our lab to further understand how each of the CSPG variants interacts with the substratum.

The financial support from the Beckman foundation has allowed me to present my project at many research conferences including: the International Neurotrauma Society Symposium in Santa Barbara, CA, the National Neurotrauma Society Symposium in Las Vegas, the Beckman Scholars Symposium in Irvine, CA, the National Conference for Undergraduate Scholars in La Crosse, WI, the Kentucky Spinal Cord and Head Injury Trust Symposium in Lexington and Louisville, and the Showcase of Undergraduate Scholars at UK. I am grateful for these opportunities to share my work and learn from scholars in my field.

My Beckman experience has been invaluable both personally and professionally. With each setback in the lab, I learned to troubleshoot, ask for help, and think critically. It has prepared me well as I take on my new challenge of completing my training to become a physician-scientist, and I am immensely thankful to the foundation and the Snow lab for investing in me.