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Summer Research Report

During the summer of 2016, I interned as a research assistant for Dr. Robert Bachman, a Chemistry professor at Sewanee for 8 weeks. I had previously taken part in research with Dr. Bachman during the spring semester before, working on a project that involved synthesizing a derivative of a ruthenium based anti-cancer drug, a drug that is currently undergoing clinical trials. While the trial drug, KP1019, has proved to be more promising than other current chemotherapy treatments, its mode of action is not fully understood. To understand the metal center's role in the action of this drug, a Pt^{4+} derivative of KP1019 was synthesized.

Towards the end of the spring semester, I found a synthesis that yielded the purest product. My goal at the beginning of the summer was to optimize the yield and to recrystallize the product in order to confirm the structure of the complex. Over the summer, my responsibilities included running reactions, calculating the percent yields, and characterizing the products using Nuclear Magnetic Resonance (NMR) Spectroscopy, Infrared (IR) Spectroscopy, and UV-Vis Spectroscopy. Optimizing the yield of the product took several weeks at the beginning of the summer. The reaction I was trying to optimize occurred by heating the reactants in a slightly acidic polar solvent over the period of several hours then cooling overnight. After several weeks, I discovered the right set of conditions was found. Refluxing the reactants in a slightly acidic less polar solvent yielded a pure product.

I was able to recrystallize the product, and several samples were sent off for X-Ray Crystallography. The results came back one week later and revealed the actual structure of the complex we were making. While we believed we were making the trans isomer from NMR data, the crystallography data showed that we were actually making the cis isomer. While this was an advancement, I still had to discover the right method to synthesize a trans isomer. After running

many different reactions and reading the scientific literature available, I found a method used for a similar compound. I used this method on my own reaction and yielded a pure trans compound. I spent the remaining weeks of my internships optimizing the yield of the trans product and recrystallizing the trans isomer. I plan to continue working on this project in the upcoming semester. Now that there are pure compounds and their structures have been confirmed, future tasks on the project include studying the compounds behavior in different conditions and running cytotoxic assays.

Over the summer, I acquired many skills in the lab that are also useful beyond the academic realm. One of the skills that was necessary for lab work was patience since many of the reactions that I ran took at least a full day or more to run. It took many trial and error reactions over the course of several weeks to optimize the yield of the cis isomer. It also took several weeks to optimize the yield of the trans isomer, and while the literature provided a new method, the researchers in the literature also spent weeks or even months developing that method, proving that patience is key in chemistry research. Multitasking was also a valuable skill I learned this summer. While several reactions were running, I had time to characterize another set of products or set up different crystallization reactions. With such a short time frame for research, I had to multitask in order to get as much work done as possible.

Time management was also key when researching over the summer. Some reactions needed to be run before the day was through or as soon as I could start it so that way, I could characterize it and know what steps to take next. Some reactions started earlier in the day and had to be taken off the hot plate later that night or after I had already left the lab, so I had to learn to manage my other activities outside of the lab in order to make it back to the lab on time to finish some reactions. As the summer progressed, I also learned how to be more efficient with

the tasks at hand and how to be more precise with my measurements. Filtering solids out of solvents, preparing NMR samples to be tested, and setting up recrystallizations became much easier tasks to undertake.

Before I began my research in Dr. Bachman's lab, I was always in a lab setting where I was told what to do by a professor or the instruction manual for a class. I was left up to my own decisions in research, which, at first, intimidated me and left me feeling very insecure about the initial decisions I made. Despite the fact that many of my decisions did not lead to successful results at first, my failing decisions taught me more about what I was trying to find, leading me to make more successful ones. I became more comfortable and confident in my decisions.

At the beginning of my sophomore year, I decided to go to pharmacy school. After research, I gained a glimpse of what graduate school may be like on a small level. Although I never saw myself as someone who would go to graduate school, I may consider it now. I enjoyed researching and trying to develop a new and improved drug, and I am interested in the process of developing a drug to be put on the market. Working in the lab this summer reinforced my desire to go into pharmacy, giving me a clear goal to work towards.