

# **Final Reflection on My 2018 Summer Enrichment Experience at Michigan Math and Science Scholars**

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This summer, I attended Michigan Math and Science Scholars (MMSS) at the University of Michigan and was enrolled in “Catalysis, Solar Energy and Green Chemical Synthesis.” The class focused on organic chemistry concepts and involved the completion of daily labs.

## **In the Classroom**

Every day, from 9:00 a.m. to 12:00 p.m. and again from 1:30 p.m. to 4:30 p.m., my class went to the lab and worked in facilities designed for undergraduate students in organic chemistry courses. During our experiments, we utilized a rotary evaporator (a rotovap), a spinning plate and rod, TLC plates, a UV machine, a melting-point apparatus, and an infrared (IR) spectroscopy machine.

I absolutely loved gaining the hands-on experience in the lab; it is definitely something that I would not have had the opportunity to do elsewhere. In the process, I learned many new concepts and how to perform various organic chemistry experiments, including: an amide bond coupling reaction, a Wittig Olefination reaction, a natural product isolation, a metathesis reaction, and the transfer hydrogenation.

While I really enjoyed partaking in all the experiments, my favorite was the natural product isolation. Coincidentally, this was also the experiment that my lab partner and I found to be the most challenging. The overall goals of the assignment were to determine the amount of caffeine in Mountain Dew and to extract thymol from thyme. The second part of the lab (i.e., extracting thymol from thyme) required a distillation set up that was rather complicated, involving: a round-bottom flask, a condenser, a tube connected to a water faucet, and a few other materials. The distillation apparatus was supposed to separate two solutions, but our extract was never completely pure. I definitely learned the most from this reaction, partly because it did not work as intended. As many of the graduate student instructors told me, they would already have their PhDs if every experiment worked all the time.

During the second week, we: learned about aldol reactions, “click chemistry,” were instructed on the 12 principles of green chemistry, produced our own solar cells, presented our final projects to the class, and made liquid nitrogen ice cream. My favorite lab from the second week was making solar cells that could power something small. In order to make the solar cell, I clamped together two glass plates (one covered in soot and the other covered in titanium dioxide) and added an iodide electrolyte solution to test for electricity. Parts of this assignment were really tedious because too much or too little material on one side of the plate could negatively impact effectiveness. To test the solar cells, we put them under a UV light. My solar cell had a maximum voltage (i.e., open circuit) of 0.023 V and a maximum current (i.e., short circuit) of 3 mA.

My class also took a trip to the botanical gardens near campus. Once there, our goal was to locate the natural product that we were researching. Mine was ginkgolides, and I was able to successfully identify my plant. That same day, we heard presentations from two of our graduate student instructors. They discussed their research projects and fielded our questions about their research, education, and college in general. It was really insightful to hear them tell about their experiences as undergrads and how they were first introduced to organic chemistry.

On the last day of class, every student gave a presentation about the natural product that they had researched. Prior to the course, I knew nothing about my product, so I found the assignment interesting. After reading scientific papers and creating a presentation about ginkgolides, I gave my PowerPoint to my lab group and received some helpful feedback. So, when we presented on the last day, I felt fairly comfortable with my audience and simply relayed my findings about my natural product.

### **Outside the Classroom**

When I was not in the lab or working on my final project, I had the chance to explore Ann Arbor and spend time with my new friends. I really enjoyed my time on campus, partly because the university's property adjoined the downtown area. One of my favorite aspects of MMSS was that I was surrounded by extremely hardworking and intelligent peers who loved being there as much as I did. Not surprisingly, I found that many of the people I met are taking similar courses at their high schools. Hopefully, we will stay in contact and be resources for each, especially when studying for AP tests or learning complicated materials. I believe that I met life-long friends and am excited to see what they achieve in the future.

While I was at the program, I also learned how to play euchre (a card game). It is played with four people—which was perfect for my lab group—and brought me closer with my friends. Euchre became a common “go to” after class or before bed check. On the weekends, students had the opportunity to visit Cedar Point (an amusement park) and the Michigan Science Center. Both of these trips were an enjoyable break from the daily lectures and labs. There were also many other exciting activities that the counselors organized, including trips to bubble tea, the fitness center, the swimming pool, the movies, and others that encouraged bonding among the students. Even though I worked in the lab all morning and most of the afternoon, I still felt like I had enough free time to do what I wished, making it a college-like experience.

### **Putting It All Together**

Before coming to MMSS, I did not have much experience working in a lab and using highly technical laboratory equipment. In addition to learning new organic chemistry concepts, I found that I really enjoy working in a lab and performing experiments. And, it turns out, organic chemistry is truly not the “dreaded” class everyone believes it to be. This is not to say that I loved everything about organic chemistry, but this program has shown me aspects of science that I could potentially be involved with in the future, particularly ones utilizing more math. I have a broad appreciation for the majority of the sciences, but this course made me realize that I relish proving a concept with numbers or graphs. For

example, I particularly enjoyed when we conducted the TLC analyses and reviewed NMR spectrums because one could visually assess whether the reaction worked.

After spending two weeks in a chemistry lab, I have a much better understanding of many typical methods, including: recrystallization, distillation, TLC plate reading, and IR and NMR graph analysis. Prior to attending MMSS, if someone had told me that I would be doing experiments using these methods for two weeks straight, I would have been a bit apprehensive; however, after spending time learning from the MMSS instructors and graduate assistants, and finding my way around the lab, I realized that I could perform a lot of the experiments on my own and gained a lot of confidence. There is still much more to learn about organic chemistry, but I gained a better understanding of what organic chemists do and how they perform their work.

This program also helped me to improve my research strategies. Because I had to research my natural product and present about it, I had to delve deep into scientific papers and the complicated syntheses of chemicals. After reading several scientific articles, I gained a better idea of what to look for and how to understand the complex language.

Without the Garwin Family Foundation, the amazing experience I had at MMSS would not have been possible. Thank you for this incredible opportunity!