Final Reflection on the Michigan Math and Science Scholars Surface Chemistry Program 2026

by Claire Lu

Why MMSS?

Initially, I was drawn to the Surface Chemistry course because I wanted to explore a new area of STEM. Before arriving at the University of Michigan, I had been worried about the lectures because I had not taken any chemistry course before coming here. However, I was surprised to find out that I could pick up on the topics discussed in class because they connected to many things that I had learned at school.

Lectures

One lecture that caught my attention was advanced imaging technology, specifically Photoactivated Localization Microscopy (PALM) and Stimulated Emission Depletion (STED) microscopy. These techniques allow scientists to visualize microscopic structures, reaching resolutions of only a few nanometers. To put this into perspective, the width of a single human hair is around 100,000 nanometers. PALM is interesting because it solves the limitations of traditional microscopy by controlling when fluorescent molecules are activated. Instead of having all molecules emit light at the same time and creating a blurry image, PALM activates only a small number of molecules at once, multiple times, allowing scientists to accurately determine their locations before combining thousands of images into one super high-resolution image. On the other hand, STED microscopy works to overcome diffusion, which causes closely spaced molecules to appear blurred together. Light from a molecule naturally spreads out and makes it difficult to determine its exact location. STED solves this problem by using a doughnut-shaped beam that overlaps with the excitation beam. By reducing the region of light, STED allows researchers to determine molecule locations with much greater accuracy and distinguish structures that are extremely close together. Additionally, we also discussed topics like catalysis, covalent bonds, stereoisomers, and monolayers.

During the second week of the program, my group's presentation was on metal-organic frameworks (MOFs). On the morning of our presentation, one of our group members had an early flight and was unable to present with us, so another teammate and I quickly adjusted by dividing up the slides and presenting them ourselves with very little time to prepare. Although it was unexpected, we worked together to make sure the presentation still went smoothly. MOFs are an important area of science because their unique properties make them useful for solving real-world problems. A helpful analogy we discussed was comparing a MOF to a backpack. A backpack can only hold a certain amount of items in it, but imagine being able to fit much more inside without changing its outward appearance. MOFs work in a similar way. They contain tiny pores that give them an incredibly large internal surface area to volume ratio. In fact, a specific MOF that is no larger than a sugar cube can have a surface area comparable to that of a football field. What makes MOFs especially useful is that scientists can change the metal ions and linkers used to build them, allowing the material to be specialized for different applications. This flexibility has made MOFs one of the fastest-growing areas of materials science research.

Hands-On Labs

During the first week, we performed an adhesion experiment, where we explored how different factors affect the strength of adhesives. In this lab, we created two different adhesives, one containing a y-GPS adhesion promoter and one without, and tested how well they stuck to two types of slides: plasma-cleaned slides and untreated slides. Afterwards, we scraped the adhesive off to compare how strongly each one bonded to the surface. We also used the adhesives we created to attach two blocks together. During our tour of the chemistry laboratory, we were able to use the machine that tested the strength of our samples by measuring the maximum amount of force they could withstand before breaking. This allowed us to directly compare the adhesives we created and understand how differences in the chemical composition affect the sturdiness of the samples.

Additionally, in a later experiment, we also created Mohr's salt, commonly used to manufacture iron blue and in the metal industry as the ingredient of brass coloring baths and iron plating solutions. Preparation involved creating an equimolar mixture of ferrous sulfate and ammonium sulfate in water. We carefully monitored water temperatures and added sanded iron pieces in diluted sulfuric acid. The flask began to fizz as the reaction took place, and once the solution began to approach its end, we added ammonium sulfate and checked for crystallization. In the end, we were left with a sand-like crystalline solid that had a light green color.

Michigan and Residential Experience

Beyond academics, spending two weeks in Ann Arbor was an experience as well. Coming from Southern Illinois, one of the first things I noticed was how walkable the city was. I was especially surprised by how drivers would stop to let pedestrians cross, even at crosswalks without traffic lights. It took some getting used to, but it made exploring the city safer and more convenient. Residential life gave me the opportunity to become more independent while meeting students from across the country. When I first arrived on campus, I quickly realized that some students already knew each other, while I did not know anyone. However, I began meeting new people and forming friendships throughout the program. Some of my favorite memories were outside of class, such as walking to lectures with my friends each morning, sitting outside in the sun during lunch, and exploring Ann Arbor together. Being away from home taught me how to become more self-sufficient by managing daily responsibilities on my own. I learned practical skills that I had not previously considered, such as doing laundry, keeping my living space organized, and following basic dorm etiquette. Additionally, I learned the importance of getting to know the people around me and helping others when needed.

Final Takeaways

All in all, the Michigan Math and Science Scholars Surface Chemistry program was an experience that challenged me academically while also helping me grow personally. Beyond the knowledge I gained, this program pushed me to step outside of my comfort zone and connect with people from different backgrounds. I am incredibly grateful to the Garwin Family Foundation for providing me with this opportunity and allowing me to participate in a program that I otherwise may not have been able to attend. Because of their support, I was able to experience a side of STEM that extended beyond what I could learn in a high school classroom. Before attending MMSS, chemistry was a subject I had never studied, but after two weeks in the

program, I have developed a much greater appreciation and am excited to formally take chemistry next year as a sophomore.