

## **Final Reflection on My 2026 Summer Enrichment Experience at Southern Illinois University Carbondale**

*By Mollie Mandell*

This year, I thought, I would craft the perfect application, get into a prestigious summer program, and prove to myself that I can stand out. However, things don't always work out as one expects them to, and as a chronic perfectionist, it was difficult for me to deal with. I had planned everything out, from my essays to even the supplies I would take with me. What I wanted most out of this summer was an opportunity to learn, explore, and gain laboratory experience. I worked for hours, and when I finally submitted my applications to programs at the University of Chicago and Washington University St. Louis, I felt a weight settle on my chest. Putting so much pressure on myself to get in was never a good idea, but as I opened the WashU decision in the cafeteria after my Strength class, I felt blank when I read that I had been waitlisted. Theoretically, that shouldn't have been as bad as rejection, but it was almost worse: I had hope. When the waitlist decision from UChicago followed a few weeks later, I knew it was over. I resigned myself to spending the summer working, rehearsing, and studying. I actually warmed up to it after a while; even if I didn't spend the season on a grand adventure, I knew I would still have a great time. However, when the Garwin Family Foundation approached me with the opportunity to do research in Dr. Mary Kinsel's lab at SIU, I was immediately interested. Within a few hours, I had thought it over enough to respond with an affirmative.

The next week, I was able to tour the Gower Translational Research Center and meet Dr. Kinsel and her husband (also Dr. Kinsel) for the first time. I raced to the building after school and walked into the mostly-empty building with both excitement and apprehension (would it really be me if I didn't feel any anxiety?). They showed me around and I was surprised to find how much fit into the deceptively small structure. The facilities in Gower include the Fermentation Science Institute, BioLaunch offices and meeting rooms, three BioLaunch Cores (labs), a Fisheries lab, a laser lab in the basement, and massive construction that takes up almost half of the building. After we finished the tour, Dr. Kinsel took me into her lab, the Mass Spectrometry Core, and shared a project she was working on (something about B vitamins) with me. As I looked at the chromatograph, I began to feel lost, even with her explanations. At that point, my only knowledge of chemistry was from the Chemistry I course I had taken previously, and I worried that I would not be able to keep up. Still, though, when she showed me the project I would be helping with, I made an effort to understand. I was to assist a graduate student in her lab with her master's thesis: smoking hemp cigarettes to test them for heavy metals. Once Dr. Kinsel finished explaining it to me, it set in that I would be doing something that summer that I had never expected, and yet was excited for. I said my goodbyes and headed home. Over the next month, I kept myself busy; from running Summer Reading programs at the library where I work to practicing guitar, there was barely time to think about my upcoming internship. Still, I did

some research on mass spectrometry and chemistry so that I wasn't entirely new to the field when I started. When I went back to Gower for my first day in the lab, it didn't feel real. I hadn't even known about the opportunity for that long, and it was already time. I was most uncertain about the fact that I had yet to meet the grad student I would be working with, Chloe Hillyer. Dr. Kinsel had praised her to me, but I worried that she wouldn't like me or would be difficult to work with. Luckily, when we met, we got along well. That day, she showed me around the lab in greater detail than I had seen before, and taught me about the Inductively Coupled Plasma Mass Spectrometer (ICP-MS), the main instrument used for her thesis. Then, I was allowed to pour nitric acid wash out of digestion tubes as Chloe refilled them with water. We also had the chance to go over to Neckers, the chemistry building, to retrieve new waste containers. My greatest revelation that day was a better explanation of what my role would be in the project. Chloe told me that the filters used in her smoking machine to catch particulate matter from the cigarettes were presenting with background metals and skewing her data. My task over the summer was to help her wash the filters with acid dilutions in order to (hopefully) remove the trace metals. To start, we soaked some filters in 10% nitric acid overnight. At the end of the day, Dr. Kinsel provided me with more information about the ICP-MS, and I was told to read up. When I went home, I was filled with anticipation about what would come next; I had already learned so much by the first day, so what else would I gain throughout the next six weeks?

The first week mostly served as an introduction to the project and the lab techniques needed to fulfill it. I was only in the lab for three days each week, so I also learned how to be organized in my research and get everything done. To start the second day, Chloe and I poured off the nitric acid that the filters were soaking in and rinsed them, then left them to dry. While we waited, I dumped more wash waste from tubes, and we removed trash from an instrument that was being installed. The best part of that day was replacing the argon tanks for the ICP-MS, though it was somewhat dangerous. I mostly watched Chloe do it, but I was allowed to move one tank into its place. Afterwards, I read about the MALDI-TOF MS, the new mass spectrometer that wasn't working yet. Once the filters seemed dry, we heated them in the oven and then refluxed them with a hot block while they were in an acid-based extraction solution. We then isolated, diluted, and filtered the liquid so that it would be ready to run in the ICP-MS. The next day, we had hoped to run the samples, but were interrupted by the familiarization training for the MALDI-TOF MS. It was interesting to learn about, but Chloe and I rushed to start up the ICP-MS right after the engineer finished talking. She showed me the procedure to turn on the instrument, and after a few clicks on the computer, it ran. Three hours later, we looked at the data and found that the nitric acid dilution had successfully reduced the metals background, but not by much. Chloe and Dr. Kinsel talked through their next steps and decided to continue with the nitric acid washing in order to find an average background metals number and subtract it off of the quantitation from the cigarettes. I thus ended my first week at Gower with a more concrete plan and goals to improve my skills and independence moving forward.

My second week began with a modification of Chloe's original washing procedure: she and Dr. Kinsel concluded that the rinsing had not been enough, so we went to Neckers once more to collect a benchtop rocking table. This, they hoped, would allow the acid to fully separate from the filters, as they could sit in water that was constantly in motion with the rocker. That day, I was also able to commence a literature review by looking for articles that would help Chloe with her research, a skill that I found very useful for the rest of the internship (and probably for the rest of my life). Before we left, we soaked another batch of filters in the nitric acid dilution, which we left to rinse on the rocker the next morning. After they were washed, we let them dry. Another change to the initial method was that we would let them dry overnight, as the last batch had looked slightly burned when placed in the oven (though that could have been the nitric acid). For the rest of the day, I took the opportunity to organize the articles I had found previously into an Excel spreadsheet, another skill that will serve me well in the future. When we came in that Thursday, we put the filters in the oven, and then I was allowed to pipette the extraction solution into the digestion tubes, which I was very happy to do. Throughout the digestion process, I was able to prepare my own three samples, and I was grateful for the increase in independence and trust. Chloe also guided me through preparing a batch on the ICP-MS computer program as we turned it on. All of a sudden, it felt like I was learning so many useful skills, and I began to feel more sure of myself. When the batch was finished, Chloe formatted the data and discovered that the soaking had, in fact, worked better than the rinsing, so we decided to continue with it going forward. Even though that week included some sitting around as we waited for samples to finish, I gained so much knowledge and independence within the lab, and I was ecstatic to come back the next Tuesday.

When the third week started, I finally settled into a routine. Chloe had soaked filters the night before, so I began the rinsing process before letting them dry. The most important thing I learned from that day was the importance of setting goals. Dr. Kinsel gave me an assignment to write a scientific report about our methodology and how it fits into Chloe's research, and I was excited to have a direction to work towards. Instead of reading or preparing for junior year while we waited for the scientific process to happen, I spent my time researching, writing, and gathering data for the paper. That week, I resolved to take notes about the filter soaking protocol so that I could be accurate when describing it. Before leaving, we soaked more filters. When we came back the next day, we put the first batch of the week into the oven and rinsed/dried the others. However, a small redirection came our way; Chloe was to attend the American Chemical Society conference at the end of August, and instead of presenting a poster like she originally planned, she would have to make a slideshow and deliver a long speech about her research to many people. This meant that she would need data faster, so we pivoted our plans that day to include a field trip. After drying the filters, we made our way to one of the Life Sciences buildings on campus and traveled to the basement to find the room in which the infamous smoking machine remained. It had a storied past, but at that point, it was being used for Chloe's project. She took a cotton swab and sampled the mouth of the instrument for tar from smoking the hemp cigarettes,

but was not able to collect much. When we made it back to Gower, we digested the next batch of filters as it began to downpour. As I made to leave, I saw the flooding outside and decided against it. Then, a group of grad students from the laser lab downstairs came and asked if our lab was flooding (it was not). As it turns out, the basement was, so we went down to help them clean up. On Thursday, we finished the last batch but did not end up running the samples. I continued to work on my report—finding references, saving them in a spreadsheet, and formatting my materials—until the end of the day. It was amazing to have my own project to work on and practice my scientific writing skills, and I worked on it throughout the weekend after I went home.

By the next week, I was independent enough in the lab that I was pretty much able to continue with the filter soaking project on my own while Chloe watched. While the filters were drying, Dr. Kinsel discussed a paper she had found on alternative acid washes with us. The authors concluded that both citric acid and hydrochloric acid (HCl) were both effective at leaching lead, so we decided to soak some batches in each diluted acid to discover whether they would work better than the nitric acid. We made the HCl solution that day, which was somewhat scary, but only until I realized that there was much more of it in the extraction solution than the dilution we were working on. Afterwards, I sent the draft of my report's methods section to Chloe and Dr. Kinsel, who gave me feedback and helped with structure. It was nice to have people there who I knew would (hopefully) not judge me, but were knowledgeable enough to give me constructive criticism. The next day, we digested the last batch of nitric acid-soaked filters, a process that felt natural to me at that point. We also did some other administrative tasks, including replacing the secondary containers for acids and remaking the 0ppb blank of the calibration curve for the ICP-MS. When Thursday arrived, we were ready to run the nitric acid samples, but also dealt with a welcome interruption: I was interviewed by a staff member of SIU Communications, who wanted to learn about my sponsorship and role in the lab. It was both an interesting and nerve wracking experience, but I'm glad I was able to do it. By the time it was over, I was able to finish the HCl-soaked batch we had been working on throughout the week, and Chloe finished running the ICP-MS. The results came, and they were mixed; there was an inconsistency between batches that was probably caused by opening a new package of filters, but we could still make an average, if that was what we still wanted to do. At that point, though, my project had shifted more towards seeing which acid was better rather than quantitating the average background. With a small bit of uncertainty, we prepared for the penultimate week.

It didn't begin in the most exciting way. On Tuesday, I mostly worked on the introduction of my report, and then soaked a batch of filters in the citric acid solution we had made previously. The next day, though, we knew it would be more interesting. A film crew was coming in to produce an advertisement for SIU, and they needed "actors" for some scenes. We continued with the citric acid filters as we waited to be called, but were pretty distracted; there were more people than we had ever seen in Gower, and we could watch through the window as they set up in the

Biotechnology Core next door. I eventually had the opportunity to be in a shot in which I set a microscope down, which was a lot of fun, and Chloe was filmed as she wrote a stoichiometric equation in the FSI teaching lab! Still, though, we didn't get much done. The next day, we resolved to run the samples we had left in the ICP-MS and retrieve the data we needed. However, there was one small problem: it wouldn't run. No matter what tune solution we tried, the counts were way off, and it failed its performance report each time. We shut it down, and I digested the citric acid filters and soaked digestion tubes in nitric acid wash as we waited for it to cool. We were also able to refill the giant nitric acid dilution dispenser, which was awesome!! Once the instrument was done cooling, we opened it up and attempted another possible solution by cleaning its cones. These are what separate the ions, and they're very delicate, so I was nervous when Chloe entrusted the cleaning of one to me. Afterwards, we reinstalled them and checked on the plasma torch. By the time we finished with all of that, we had run out of time, so we desperately hoped our fixes worked for when we came back in my final week.

Spoiler alert: it didn't work. Chloe had come in the Friday prior to test the instrument, and nothing had changed, even when she remade the tune solution. Still, she had a plan. She had found a slideshow with troubleshooting for low sensitivity, so we made our way through each fix throughout the day. However, after looking at various reports, remaking the tune solution again, and checking on the cones, lenses, and plasma torch, we still couldn't find the root of the problem. We were left with two main options by the end of the day: replace the cones (an expensive fix) or wash the torch. We decided to test the latter and leave the replacement as our last resort. The next day, an engineer had responded to an inquiry Chloe had sent and had asked her to send over the ICP-MS' performance reports. She did, and he immediately realized that our cones needed to be replaced when he saw an issue with the vacuum in the instrument. Once we replaced them, it seemed as though all of the problems had magically been fixed; even the oxide ratio, a historic issue, was no longer in the red. We were able to run the calibration curve and the last nitric acid batch that day to see how much the numbers had changed, and it turned out fine. Then...I came in for my last day. It really snuck up on me. We had so much to do because of the delays, and I needed to finish my report. While we ran the final citric acid and HCl samples, I rushed to write the intro and complete what I could without the data I needed. At the end of the day, we discovered, to everyone's surprise, that the citric acid was most effective at reducing the metals background. Who knew? Before I left for the final time, I promised Dr. Kinsel that I would finish the report before the beginning of my school year and wished Chloe good luck on her thesis. And then I was gone.

The end of my internship was almost unexpected to me. It was such a big part of my life for over a month, and I had built such an integral routine around it, and I would likely not see Chloe or Dr. Kinsel again. Honestly, it aligned with so many of my original expectations for this summer and somehow exceeded them, despite me not being where I had initially planned to go. I had been able to gain my independence in the lab and learn what it was really like to do research, as

well as heading a project of my own and writing a scientific report. Compared to UChicago, I had much more freedom to do what I wished in a lab setting. I missed meeting new people and making friends from around the world, of course, and the overall experience of a residential program, but I knew nothing I did would live up to last year in those respects.

Doing research at SIU allowed me to explore the campus and learn more about the inner workings of a rural university. They always say that the kids around here “don’t realize what’s in their backyards,” and they’re not wrong. There are so many great research opportunities at SIU that I had not been aware of before. I also had the opportunity to explore Carbondale more than I ever had before. Those eightish miles used to feel so far away, but now it feels normal to make the trek. Over the course of my internship, I tried different coffee shops, discovered great ice cream, got more comfortable with the one-ways, and memorized the route to Gower like the back of my hand. It almost felt poetic as I went home on the last day and was able to drive through the new construction on Route 13 for the first time.

While I enjoyed my class at UChicago, I didn’t really have an opportunity to get to know many of my classmates, so one of the best parts of my internship this year was working closely with the same two people and building trust with them. Dr. Kinsel, Chloe, and I were the only people doing research in the Mass Spectrometry Core during the days I was there, and we would often be the lone group in the building. I spent most of my time sitting at a table next to Chloe with Dr. Kinsel in her office a few feet away. When I started out, I was pretty quiet, but as the days went on, Chloe and I began to talk more and share stories. I learned where she was from, how pampered her dog was, and what she plans to do after she graduates. Though she only allowed me to do small tasks like soaking digestion tubes at first, I got to the point where I was running the ICP-MS and preparing samples alone. As for Dr. Kinsel, I did not get much of a chance to work with her as she was mostly participating in her own research over the summer, but I always made sure to step in her office and chat with her every day. She inspires me so much; she is very self-sufficient and is not unwilling to make her voice heard, especially regarding the study she is so knowledgeable about. When I stepped out of the lab and explored the rest of Gower, I tended to see the same few faces; Ken Stoner made it a habit to talk to me, and Amanda Rothert never failed to give me a smile as we passed by each other. I always felt very welcome there, even from the receptionist I rarely saw and the occasional grad student who peered through the core’s window.

The lab experience I gained is invaluable to me. High schoolers rarely get the chance to do wet lab research, but I had the opportunity to do both that and instrumentation. The ICP-MS was a mystery at first. I had done a bit of learning on mass spectrometry beforehand, but when Dr. Kinsel handed me a thick packet of details about the spectrometer, I knew I was in for some humbling. As a person with only a year of non-honors chemistry experience, it took me a while to wrap my head around the method of the ion separation and detection of the instrument, but I

learned quickly (to think that people get PhDs in areas like this!). When I had first told my chemistry teacher about the internship, he told me that I would have to teach him something about it in the fall (slightly worrying), and I didn't think that I would be able to understand it, but Chloe put it in such clear terms that I was excited to figure it out. I learned all of the starting procedures—from opening the gas tanks to tightening the peristaltic tubing—and was also allowed to create batches and get to know the program that the computer uses to analyze the samples. Besides mass spectrometry, I was able to handle dangerous substances including acids and was trusted to use lab techniques such as micropipetting (which I learned last summer). I didn't just spend my whole time there doing dishes, though that was assigned to me on occasion. It wasn't all exciting, though; I gained firsthand experience of what science is truly like. For most researchers, much time is spent waiting, gathering data, and waiting some more. I didn't mind it much, especially when it allowed me time to work on my final report. Dr. Kinsel and Chloe always heralded their philosophy of gradual science, which they claim (and I found) works better to produce accurate research. Chloe once told me a cautionary tale about an undergraduate student who always rushed his work, to the point where all of the data on his samples were discredited. *Ouch*. It was nice to have the reality check that scientific research isn't always discoveries and glory; the quieter moments are what count.

One of the greatest struggles I dealt with during my internship was balancing it with other aspects of my life. I was at Gower for around 15 hours every week, working for another 20, rehearsing for a musical for at least 5, and had to drive in between all of that (I will always remember this summer for how much time I spent in the car). On top of everything else, I also had family responsibilities and wanted to relax a bit during what was ostensibly my break. I've always been a busy person, though, so it wasn't anything I had not prepared for. I did let some things fall behind, like running and preparing for school, but I was mostly able to keep a consistent schedule, even if I was slightly tired all of the time. Living at home was difficult for me, as when I was at UChicago, I had my own space and did not have to think about anything else except for the program. It was pretty stressful, but I also got to have so many amazing experiences through this internship, so I consider it to be worth the sacrifice. Another problem I dealt with was the ICP-MS' sensitivity problems, which came up over the last two weeks of being there, and delayed my report so that I had to finish it after school started. That also contributed to my stress a bit, but I was able to get it finished and I'm satisfied with the completed result.

For anyone who wants to get more lab experience and/or feels like their school doesn't provide enough, I would definitely recommend a research internship, whether at SIU or another university. I learned so much from working with Dr. Kinsel and Chloe even though it wasn't something I had initially considered when planning this summer. A person who would be most successful doing something like this is someone who is patient and learns quickly. Another big factor in a future Garwin student's enjoyment is whether they like repetitiveness; I spent many

weeks performing the same method over and over, but I've always found mundane tasks to be calming. I definitely recommend this to any Garwin sponsoree, whether they struggle with placement in summer programs or just want to do research in general. It took me a while to accept this, but you don't have to be ashamed of staying home. I was still able to have an amazing summer at SIU, and just because it's not on the same level of prestige as schools like UChicago does not mean that its rigor is significantly lower. In fact, I appreciated being in a small lab with few people, as I was able to work closely with Chloe and Dr. Kinsel and felt like I made a genuine connection. I will admit, I am not a big fan of group projects with my peers, as last summer my final poster group was not great, but it was different doing research with a group of adults. I knew my place with them and was grateful they allowed me to have as much independence as they did. One of the most valuable parts of my summer was the ability to explore my interest in chemistry, which isn't something I expected. I initially applied to only biology-related programs, as that is a major passion of mine, but chemistry is also something I'd love to learn more about, as I found throughout my sophomore year. Now that I'm taking AP Chemistry, I've discovered that a lot of the information I learned this summer is very applicable to the concepts discussed, and I can't help but be interested. I'm not exactly stepping away from biology, but chemistry is beginning to captivate me. Compared to last summer, I've also become much more independent, and this internship has helped me to become confident in a lab setting.

While it wasn't exactly what I planned, this summer turned out to be as much of a learning experience as I had originally hoped for. I had the opportunity to practice instrumentation and laboratory techniques, independently write a scientific report, and be taught by two very intelligent and friendly individuals. Dr. Kinsel and Chloe Hillyer are amazing people, and I will never forget the impact that they have had on me. I learned about different aspects of chemistry and how it could relate to my future career. I met instrument technicians/engineers, industry representatives, master's and PhD students, and professors. All of those are fields whose paths I could follow, and as I go into my junior year, I have to consider what my life after high school is going to look like. This experience has given me some invaluable insight regarding college and jobs, and I hope to take it into my senior year. Despite spending over half of my summer in the internship, it felt like it flew by. My final day hit me like a truck, and I realized I'd probably rarely or never see the people of Gower again. It impacted me more than I thought it would, and that's because I was able to make a genuine connection with everyone. I was so close to home that nothing and no one felt unfamiliar at that point. Even as I drive across Route 13, I remember all of those early-morning rides to Gower, and I haven't been back to the coffee shop I frequented because I know I'd feel nostalgic somehow. Of course, none of this would have been possible without the Garwin Family Foundation. The support I received from them was immeasurable, from showing me the opportunity to paying for my gas to letting me borrow a laptop (thanks, Vanessa!). I always felt like I had them in my corner, another great advantage of being near home. I will always appreciate the GFF for what they have enabled me to achieve, and I hope that I will continue to work with them to build an awesome summer next year!