

Ethan Yager

Research and Cultural Experience Through the Taiwan IRES Program

When I found out I had been selected for the NSF International Research Experiences for Students (IRES) program in Taiwan, I was extremely excited, but I was also nervous. This would be my first time leaving the United States and my first time conducting research internationally. I had never lived somewhere where the language and culture were so different from anything I knew, so I really did not know what to expect. When I finally arrived in Taiwan, everything felt surreal. For the first several days, I constantly had moments of thinking, “I can't believe I'm actually here and I'm going to be living here for two months.” One of the first things that made the transition easier was how kind everyone was to us. From the airport staff to the students who helped us when we arrived, people were welcoming even when there was a language barrier. Not everything went exactly according to plan, though. When we arrived, our original dorm was still occupied, so we had to move into a different dorm and then move again about two weeks later. It was a small problem looking back, but it was also one of my first lessons in having to adapt while living in another country.

The main reason I traveled to Taiwan was to conduct research at National Tsing Hua University in Hsinchu. I worked under “Professor Che-Ning Yeh”, with ‘Han-Yi Chen, who goes by Alvin, as my direct mentor, on the synthesis and electrochemical evaluation of $\text{LiNi}_x\text{Mn}_{2-x}\text{O}_4$, or LNMO, cathode materials for lithium-ion batteries. Before this summer, my research experience had been in very different areas, so electrochemistry and battery research were almost completely unfamiliar to me. I was excited to learn something new, but I was definitely intimidated by it at first. I prepared as much as I could before beginning, and it felt good when I realized that preparation showed and I was able to impress my PI with what I already understood. As the summer continued, the hardest part became not necessarily performing the experiments, but learning how to interpret the electrochemical results and explain why our material could or could not be considered a good battery material. I had to understand the chemistry well enough to defend my reasoning rather than just repeat what someone else had told me. Eventually, there were moments when Professor Yeh or Alvin would ask me a question

and I could answer quickly and correctly. Even something as simple as doing the calculations correctly while cutting the LNMO-coated aluminum foil gave me this feeling of, “Okay, I actually know what I’m doing now.”

My favorite part of the experimental work was assembling the coin cells because I went into it expecting the process to be much harder than it was. Once I understood how all the components came together, it became something I really enjoyed doing. Surprisingly, nothing major went wrong during my research, although Alvin and Professor Yeh still taught me what could go wrong and what our next steps would be if it did. Our battery had room for improvement, but that was also the entire purpose of doing the research. I started to understand that research is not about everything working perfectly the first time. Sometimes the parts that could be improved are what give you your next question. I also learned to pay much more attention to small details. For example, learning to look for streaks and other visual changes during parts of the preparation taught me that something that looks insignificant can actually tell you a lot about whether a process is complete. Those small lessons helped develop my analytical skills because I was learning to actually observe what was happening rather than just follow a procedure. Alvin especially made that learning process comfortable for me. Whenever I asked questions, he made me feel smart and heard rather than making me feel like I should already know the answer. The rest of the lab was welcoming as well, and even though I did not become extremely close with everyone, I always felt like I could ask someone a question.

Being in Professor Yeh's lab also gave me a different view of what my future in science could look like. At UTPB, I am used to working alone or with one other person in the lab, while at NTHU there were many more people working in a relatively small space. I had to learn how to work around other people and share equipment and space, but I actually enjoyed being surrounded by master's and PhD students who had similar interests and goals. Instead of making me feel out of place as an undergraduate, it made me feel like I belonged there. I could see graduate students interacting, doing their research, asking questions, and working through problems together, and I could picture myself eventually being in their position. The research itself also changed how I viewed chemistry. I had previously thought areas like battery research and electrochemistry would be much harder for me, but once I was actually doing the work, I

realized that I could learn it. It made me want to explore areas of chemistry outside of what I was already comfortable with, especially inorganic chemistry. More importantly, the experience strengthened my goal of earning a PhD in chemistry, and now that I am back in the United States, I am actively looking at and applying to graduate programs.

As important as the research was, Taiwan became much more than the laboratory. After a while, Hsinchu started to feel like somewhere I actually lived instead of somewhere I was visiting. I developed my own routine of walking to McDonald's or 7-Eleven, going to the lab, returning to the dorm after the day, and sometimes heading to Grandma's place. One of my favorite restaurants near campus was MKK Ramen Studio, and we went there enough that the people working there learned our names and our orders. Those small things made Taiwan begin to feel familiar. I also started making friends outside of the IRES group. I met one of my friends at the food court, and eventually he even took me around on his moped. I made another friend who was very interested in science, so we would talk about our respective research. I was proud of myself for being able to make those connections on the NTHU campus because I had arrived knowing almost no one. Even the cultural differences that seemed strange at first eventually became normal. Taiwan felt much quieter than Texas. I am used to Southern hospitality being loud and talkative, while people in Taiwan often seemed more reserved. By my last month, though, I had grown to appreciate the quiet. I also learned small parts of Taiwanese culture simply by watching the people around me, including food etiquette and how people placed their chopsticks when eating. It made me realize that learning about another culture does not always happen because someone explicitly teaches you; sometimes you learn just by paying attention.

At the same time, I had several interactions that showed me how kind people in Taiwan could be. In Hsinchu, Axel, my roommate, and I met an older woman while we were in a small shopping area. She started talking with us about the United States and about her own life in Taiwan, and she was just genuinely interested in having a conversation with us. We had another experience in Taitung with a woman we met while waiting for a bus who talked with us and shared some of the fruit she had bought that morning, and we shared some of ours with her. These were such simple interactions, but they became some of the moments I remember most because these people had no reason to stop what they were doing and be kind to a group of foreign students. Of all the

places I visited, Taitung became my favorite. My best day of the entire summer was probably there. We woke up, the hotel made us breakfast, and then we took the bus to the beach and spent a couple of hours swimming. Afterward, we returned to the hotel and spent the rest of the night playing games until we went to sleep. Taitung was beautiful, but what made it my favorite was how peaceful it felt and how friendly and talkative the people were.

Of course, living abroad for two months was not perfect, and I think the difficult parts were just as important to the experience. I became sick for about a week, and that was when I felt the most homesick. Being sick in another country made the distance from Texas feel much larger because I did not have my normal circle of friends and family around to help me. I missed them throughout the summer, along with some much less serious things like having air conditioning everywhere and, probably most importantly, Whataburger. At the same time, there were things about Taiwan that I immediately missed once I returned, especially how accessible public transportation was and how simple it was to use an EasyCard to get around. By my final week, I was ready to go home because I knew I would not actually be in Texas for very long before leaving again for Washington, D.C., but it was still surreal knowing my time in Taiwan was ending. I had spent the beginning of the summer thinking, “I can't believe I'm actually here,” and suddenly I was thinking, “I can't believe I'm already leaving.” Even landing back in the United States felt strange because everything somehow felt familiar and unfamiliar at the same time.

Looking back, I think Taiwan prepared me for much more than research. Only a few days after returning to Texas, I was preparing to move again for my Archer Fellowship semester in Washington, D.C. Moving across the country would probably have intimidated me much more before this summer, but Taiwan gave me a different perspective. I could tell myself that if I could move across the world, live and prosper in another country, conduct research in a subject that was new to me, and build friendships with people I had never met, then I could manage living in another state or district. I returned feeling more accomplished, independent, and especially more driven to earn my PhD in chemistry. If I were given the opportunity to return to Taiwan tomorrow, I would absolutely go back, although I would make sure I had more money saved and more time planned to explore the entire island, especially Taipei. There is still so much I wish I had seen. I originally thought I was going to Taiwan just to learn about chemistry, but I ended up learning about the culture, the people, the good and bad parts of living abroad, and a lot about

myself. Through Professor Che-Ning Yeh, Alvin, and the other researchers at NTHU, I learned about batteries, electrochemistry, materials science, and international research, but Taiwan also showed me that I am capable of going somewhere completely unfamiliar and finding my place there. More than anything, the experience made me more confident about the scientist I want to become and more willing to go somewhere unfamiliar to get there.