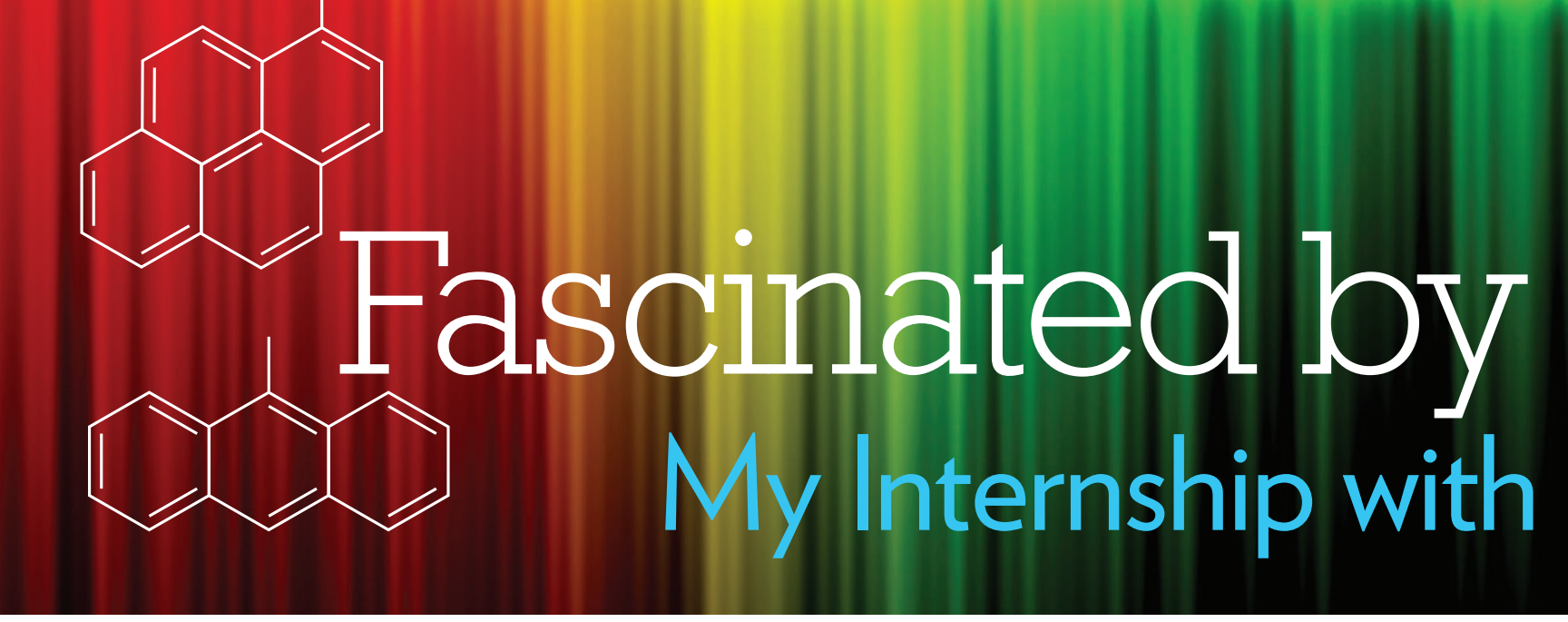

Fascinated by My Internship with

by Briana Sealey

I HAD NEVER HEARD OF PROJECT SEED when my high school advisor suggested that I apply to this program at Case Western Reserve University. It was the spring of my junior year, and I was looking for a science internship for the coming summer. When I learned that Project SEED was a research program sponsored by the American Chemical Society, I wasted no time in applying. I submitted an essay describing my love for science and my excitement at the prospect of working as a part of a research group. About two weeks later, I received an acceptance letter.

I hoped that this experience might help me decide what area of science I wanted to pursue. I loved all areas of science—biology, chemistry, physics, astronomy—but had no idea where I wanted to focus my energies. Project SEED would allow me to learn what it's like to be a chemist. As excited as I was, I was still a little nervous. I had taken Honors Chemistry, but I would be making a big jump from high school science to working full-time in a university lab for eight weeks.

Joining the Team

I was assigned to work in the laboratory of Dr. Carlos Crespo-Hernández in the Department of Chemistry. Dr. Crespo's group conducts research focused on understanding light-induced molecular reactions of relevance to biology, renewable energy, and the environment.

When I arrived at his office in late June, he welcomed me with a huge smile. During our meeting—the first of several we'd have over the course of my internship—he explained how important it is to understand the world at a microscopic level so it can be understood at a macroscopic level. He also described his own research and shared the educational decisions he made on his way to becoming a professor. These discussions were always inspiring and left me wondering more about how the world worked at an atomic and molecular level.

On my second day, I met Aaron Vogt, the graduate student who would be my mentor. As we would do each day of my internship, Aaron and I met in an office in the Millis Science Center before heading to Dr. Crespo's lab in the basement of the building. On my first visit to the lab, Aaron pointed out some of the equipment we'd be using, including a spectrometer, a high performance liquid chromatography (HPLC) instrument, and a xenon arc lamp, which is used to simulate sunlight. I didn't have access to equipment like this in my high school and was excited to learn how to use it.

The Compounds in Question

My work was part of the Crespo group's research on nitro-polycyclic aromatic hydrocarbons (NPAHs), a class of environmental pollutants that are released into the air in emissions from cars, factories, power plants, incinerators, and other sources. Some NPAHs also form in the atmosphere from reactions of PAHs. Regardless of their source, many NPAHs have been identified as carcinogenic or mutagenic agents. And they are likely to become even more abundant in the environment as developing countries burn increasing amounts of petroleum and coal.

What happens to these pollutants once they get into the atmosphere or the water supply? How long do they stay there? How do they break down, and what do they break down into? I hadn't thought much about questions like these, but in Dr. Crespo's lab, I got a crash course on this complex topic.

I learned that NPAHs do degrade into other compounds with exposure to sunlight; however, these photoproducts can be even more toxic than the NPAHs they form from. Dr. Crespo's group is studying these degradation processes and the resulting chemical products in their lab so that models can be created to help understand how NPAHs behave, persist, and affect air quality.

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Photochemistry
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Light Effects

My first task was to measure how much light of different wavelengths was absorbed by two NPAHs: 9-nitroanthracene (9-NA) and 1-nitropyrenen (1-NP). Using the lab's spectrophotometer, which measures how much light of a given wavelength is absorbed by a compound, I conducted an experiment with different solvents containing varying concentrations of these compounds. My goal was to test whether these two NPAHs adhered to the Beer-Lambert Law, which states that there is a linear relationship between the concentration of a compound in a given solvent and how much light it absorbs at a given wavelength.

Next, I investigated the light-induced degradation of 9-NA and 1-NP. I used the xenon lamp to irradiate the compounds and the HPLC to separate the mixture of photoproducts formed so they could be analyzed and characterized. In my experiments, I observed that visible sunlight does in fact degrade these two compounds into photoproducts that also absorb sunlight. The potential risk to humans of these products has yet to be determined.

My work in Dr. Crespo's lab was challenging not only in understanding the science, but also in mastering the techniques to do the work. For example, preparing samples to be inserted into the HPLC took a lot of practice: I had to make sure there were no bubbles in the syringe as I extracted the liquid. It was harder than it sounds, and Aaron often had to assist me. Another challenge was that some experiments had to be conducted in the dark with red lights because the compounds were reactive to the light from the lamps in the room.

Fortunately, the results were worth the challenge. Toward the end of the summer, Aaron helped me organize and format my research into a poster, which I presented in the auditorium of the Millis Science Center along with Project SEED interns from other labs at the university. Even more exciting, my work was included with Aaron's research on these NPAHs and prepared for communication to the scientific community. The resulting paper, "On the Primary Reaction Pathways in the Photochemistry of Nitro-Polycyclic Aromatic Hydrocarbons," was published in the journal *Modern Chemistry and Applications* in 2013, and I am one of the co-authors.

The experience I had in the lab was amazing, and working on this project for the whole summer gave me a chance to think deeply not only about pollutants and how the sun affects them, but about the power of chemistry to help us understand the world around us. Project SEED introduced me to incredible mentors, gave me a valuable lab experience, and even helped me decide to attend Case for college. It was the internship I'd hoped it would be, and so much more. i

Project SEED

A program of the American Chemical Society, Project SEED provides opportunities for high school juniors and seniors who are economically disadvantaged to spend a summer conducting research with scientists in academic, industry, and government research laboratories. Students must be recommended by a teacher and must have taken a high school chemistry course.

Students may participate for one or two summers and are paid a stipend. Participants who plan to major in chemistry or a closely related discipline in college may apply for a $5,000 Project SEED college scholarship.

Learn more at www.acs.org/projectseed.

Briana Sealey is a freshman at Case Western Reserve University. Briana is interested in biology, specifically zoology and mammalogy. She loves animals and enjoys drawing, both traditionally on paper and digitally with Photoshop, during her free time. Briana also plays the viola and enjoys singing in the shower.

Read the paper of which Briana is a co-author at www.cwru.edu/artsci/chem/faculty/crespo/group/Crespo%20MCA%202013.pdf.