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UD student Olivia Shaw, who is blind, works in Prof. Jodi Hadden-Perilla's computational chemistry lab, where Shaw uses special technology to "see" images on a tactile display device.

'A BRIGHT FUTURE IN RESEARCH'

Article by Ann Manser | Photos by Kathy F. Atkinson | April 03, 2020

Chemistry student meets challenges of blindness to find success in the lab

Like a lot of other University of Delaware students, junior Olivia Shaw found a passion for a field of study - in her case, computational chemistry – by taking part in undergraduate research on campus.

Unlike most other students, Shaw has faced special challenges that come from being blind.

But with the help of technology, supportive faculty, UD's accessibility services and her own hard work and talents, and with a boost from a special summer research program (https://sites.udel.edu/seliud/application/) for undergraduates with disabilities, Shaw is finding success in the classroom and in the lab.

"Olivia was my first student here, and it's been a great learning experience for both of us," said Jodi Hadden-Perilla, assistant professor of chemistry and biochemistry (https://www.chem.udel.edu/), who began mentoring Shaw during the summer program in June, even before her faculty appointment officially began in July. "She'll try anything and figure it out. She's absolutely fearless, which I guess is a good thing when you're a pioneer." Shaw, who grew up in Texas and has been blind since birth, was a student at Randolph-Macon College in Virginia last year when a professor encouraged her to apply to the National Science Foundationfunded summer research program for students with disabilities that UD has been holding for several years.



Olivia Shaw's guide dog is a 3-year-old black lab named Ripple.

Although Shaw had decided to major in chemistry from the first time she took a course in the subject, she hadn't previously considered the possibility of conducting research. When she heard from another blind chemist about the field of computational chemistry, she was intrigued by that area of research and expressed her interest when she applied for the summer program at UD.

"My initial basic, undergraduate view of it was: You put a bunch of molecules together in a computer and see what happens," Shaw said of the molecular simulations that are Hadden-Perilla's research specialty. "I wasn't that interested in doing 'wet lab' work [with physical samples], but I was very interested in computational work and in studying how things come together atomistically."

She was accepted into the summer program and began working with Hadden-Perilla. The experience was so positive for both of them that, although Shaw is quick to point out that Randolph-Macon is "a very good school," she decided to transfer to UD with its wider opportunities for the kind of research she wanted to pursue.

In the fall, as a full-time UD student, Shaw continued working with Hadden-Perilla's team. While she worked in the lab, her guide dog, a 3-year-old black lab named Ripple, curled up on her own cushion under the table holding Shaw's computer and other equipment.

In the lab and in her coursework, Shaw uses a text-to-speech function on her computer as well as a Braille reader, so she's able to access the words of books, documents and research articles. The challenge, she and Hadden-Perilla said, was with illustrations, graphs and other visual representations that are so important in chemistry to show, for example, the structure of molecules.



Prof. Jodi Hadden-Perilla has a 3-D model of a protein near her keyboard, the kind of representation that UD student Olivia Shaw also uses at times to visualize an illustration or photo.

Working with UD's Office of Disability Support Services, Shaw was provided illustrations with raised areas on a special type of paper, giving her access to those images through her fingertips. She also has been using a prototype of a new device from Orbit Research called the Graphiti, which offers interactive tactile displays.

To use the device, Shaw connects it to her laptop and calls up an illustration. The flat surface of the Graphiti immediately mirrors that graphic display through an array of raised pins that Shaw can run her fingertips over and "see" the same image that's on her laptop. It's not always perfectly detailed, she said, but it's accurate and extremely useful for her work.

Hadden-Perilla had attended a conference about accessibility for students with disabilities, and a representative from Orbit connected with her about having a student try out the Graphiti, which she calls "pretty amazing." She and Shaw are now helping the manufacturer learn more about what the device can do and how its features might be enhanced.

For Shaw, the challenges she's addressed in the lab are the same kinds she's handled throughout her life. In classrooms, for example, she said professors might never have taught a blind student before, but when she explains what she needs, things generally work well.



Olivia Shaw moves her fingertips over a variable-height raised image of a protein, created on special paper by UD's Office of Disability Support Services.

At UD, when a professor shows a diagram or other image during class, he or she now describes what is on the screen in a bit more detail than usual so that Shaw will be up to speed, she said. That small change has also helped some of her fellow students with no visual deficiencies, she said, who have told her the additional verbal descriptions help their understanding of the subject matter as well.

"I like to think I'm helping to pave the way for other students with disabilities because the faculty members realize that I can do this," she said.

About the research

Hadden-Perilla works at the technological interface of chemistry, physics, biology and computing, using supercomputing resources to perform molecular dynamics simulations at the atomic level.

Molecular dynamics simulations allow researchers to study the way molecules move in order to learn how they carry out their functions in nature. Computer simulations are the only method that can reveal the motion of molecular systems down to the atomic level and are sometimes referred to as the "computational microscope."

The technique allows Hadden-Perilla to study biological processes. Her team's research has focused on the structure of the hepatitis B virus and understanding other aspects of disease.

Shaw has been performing molecular dynamics simulations to further scientific understanding of selenium-containing proteins. Selenium is a trace element, essential to human health, that is folded into protein cells as they are formed.



Olivia Shaw feels the image of a protein on the surface of a new device from Orbit Research called the Graphiti, which offers interactive tactile displays mirroring whatever image appears on her laptop computer screen.

In addition to that computational work, Shaw and Hadden-Perilla are investigating ways to improve access to the computational microscope by researchers who are blind. The Journal of Science Education for Students with Disabilities recently accepted an article they submitted for publication describing Shaw's tactile protein visualization project.

The research experience has fueled Shaw's passion for computational chemistry, she said. People sometimes ask her if she chose this area of study in order to avoid the challenges she might face in working with physical samples in a traditional, "wet," chemistry lab.

"I've been asked if I feel relegated to computational work because I'm blind, but that's not the case at all," she said. "This is exactly what I want to do."

Summer program for students with disabilities

Karl Booksh and Sharon Rozovsky, both professors of chemistry and biochemistry, have been leading UD's summer research program for students with disabilities since 2013.

Students from colleges and universities across the country come to campus for the 10-week program in which they work with UD faculty researchers in their labs on a variety of investigative projects. The program, which is supported by a grant from the National Science Foundation through its Research Experiences for Undergraduates (https://www.nsf.gov/crssprgm/reu/) initiative, now has former participants attending graduate programs nationwide.

"Even more importantly, our students are ambassadors and advocates for inclusion, and I am very proud of them," Rozovsky said.

In Shaw's case, because of her interest in computational chemistry, Rozovsky contacted Hadden-Perilla, who immediately agreed to work with her during the summer.

"Olivia Shaw and Dr. Hadden have been collaborating with my research group, and it has been a fantastic experience," Rozovsky said. "Olivia is very bright, motivated, hard-working and pragmatic. She has a bright future in research."

Rozovsky said she especially appreciates Shaw's good-natured and straightforward way of explaining the challenges she faces and what tools she needs to succeed. With Hadden-Perilla, the two made a video of Shaw discussing some of these issues, which Rozovsky showed to a large group of educators at a conference.

"I told the audience that this is an example that the students know best what they need, and we should all listen to them advocating for themselves," she said. "It was very well received."

As for Shaw, she thinks that having a disability has – far from preventing her from doing research – actually helped her develop the skills that are so important to that type of work. Throughout her life, she said, she's constantly faced situations that were new and different and required her to come up with creative solutions.

"I think that translates to research, where what you're doing is trying to solve a problem," she said. "It's something I just enjoy doing."