

### From Biochemistry to Patent Law: An Undergraduate Journey

Patent law may seem like a 180-degree-turn from biochemistry, but understanding the science behind patents is crucial to the field. Sophia Vogeler, a fourth-year Biochemistry student, will be attending law school in the fall to pursue her dreams of becoming a patent lawyer.

Sophia had her plan laid out before even stepping foot on campus. She shares, “I wanted to be a patent attorney and practice pharmaceutical law, so a Biochem[istry] degree was a really important first step on that path. The best way to prepare myself was research.”

Wasting no time in getting involved, she emailed Dr. Charles Brenner in the Department of Biochemistry in the fall of her freshman year. Sharing a mutual interest in metabolism with Brenner, she believed the lab seemed a good fit.

Sophia’s targeted interest has allowed her to conduct research in the lab for the past four years. As a result, she is currently running her own study from top to bottom—an opportunity that most undergraduates do not get.

While Sophia does not plan to conduct bench work post-graduation, research is a beneficial way for her to develop critical thinking and analysis skills that will benefit her in law school.



Sophia Vogeler (L) and Dr. Charles Brenner (R) study how the vitamin nicotinamide riboside can boost metabolism.

Over the years, undergraduate students in Brenner’s lab have pursued many paths after graduation. While some have gone on to earn PhDs at institutions including Washington University and UCSF, others have gone into medicine and have held positions at the Mayo Clinic, the Children’s Hospital of Philadelphia, and

the Miami Dolphins. Brenner added, “there is such a wide range of things you can do with a background in research.”

Research does not confine students to specific career paths but rather helps them to discover areas of interest to further explore. According to Brenner, “professors are eager to work with first and second year students because they have so much time ahead of them and can make a sizeable contribution to the lab by the time they leave.”

Sophia’s early commitment to research has allowed her to make these contributions and to be part of the lab’s recent scientific publication in the journal *Cell Reports*.

Of the authors on the paper, three are undergraduates at the University of Iowa, including Sophia. Another is Michelle Moore, a second-year undergraduate studying Biomedical Engineering. Like Sophia, Michelle will not conduct benchwork in the future, rather her sights are set on medical school. Michelle shares, “learning how to talk to doctors, lab managers, and people above you, and learning to collaborate with people you aren’t used to collaborating with has really helped me a lot”. Research is the perfect segue to her professional schooling.

While they will ultimately pursue different careers, in the Brenner lab, Sophia and Michelle work together to study how metabolism can be boosted by the vitamin nicotinamide riboside (NR). NR can ultimately be turned into a form of fuel for the body. Brenner discovered NR as a vitamin and has pioneered NR research for the past 15 years.

The lab’s most recent paper studied the effects of NR supplementation to postpartum mothers (in rats and mice). They discovered that this leads to an increase in milk production and weight loss for the mothers and improved development for the offspring. In the future, this could be a great help to women and their children.

In Brenner’s lab, undergraduates contribute to the majority of experiments. “When they collect data, the undergrads are the first ones in the world that get to see the results of their projects. It’s exciting,” shares Brenner. Like Sophia’s work, these results can be incorporated into publications, posters, or talks. This spring, she will present her work in a talk at the department’s Lata Symposium.

It is often forgotten that Principal Investigators also began their career as an undergraduate researcher. For Brenner, this experience began the summer after his sophomore year at Wesleyan University.

For one month he was helping a professor write a book on Sigmund Freud, and for another month he was engaged in molecular biology research. Brenner recalled that, “during the month working on intellectual history, the professor gave me a list of index cards with quotes from Freud with which I was in charge of finding exact citations. No creativity on my part was requested.”



During the month of molecular biology research, he began research on fruit flies to determine what specific factor on the Y chromosome makes the flies male. “It turns out,” recalled Brenner, “the hypothesis was wrong, and the sex determinant is the dosage of the X chromosome.”

Tolerating failure is a major part of research at all levels and this didn’t defer Brenner from continuing to pursue a career in research. Today, his lab continues to make cutting edge discoveries and to train skilled undergraduates.

Each undergraduate student’s experience with research is unique, contributing to the culture of discovery here at the University of Iowa. Students get involved at different times and will go on to pursue different paths. Regardless, they develop invaluable critical thinking and creative skills. While many students waver on committing to research, Brenner urges students to simply “Give it a shot. There’s nothing like discovery.”

The full published research paper can be found at <https://www.sciencedirect.com/science/article/pii/S2211124719300154>