FACES OF MASS SPECTROMETRY / Kylie Bemis

Anne Brenner and J.D. Brookbank are science writers at Technica Editorial Services.

September 2025

Showing Up at the Start Line

Kylie Bemis became interested in mass spec imaging, and the statistical side of mass spec, drawn in by the complexity and challenge of working with high-dimensional datasets. After earning her PhD in statistics at Purdue University, Kylie accepted a postdoc position at Northeastern University where she currently works as a researcher and assistant teaching professor. As part of her research, Kylie designed and developed the Cardinal software package, a free and open-source tool for analyzing mass spec imaging experiments.

At the Khoury College of Computer Sciences at Northeastern University, Kylie assisted in developing several core courses for the master's in data science program. As a faculty member, one of the master's courses she teaches is the data science capstone. This teaching role provides an opportunity to keep up to date with recent developments in the field, while also emphasizing to students the importance of ethics in data science and a responsibility toward the people whose data students are working with.

As a Native American transgender woman, Kylie is a committed advocate for the communities to which she belongs. While studying at Purdue University, Kylie was an active member of the Native American Educational and Cultural Center, as well as the Purdue chapter of the American Indian Science and Engineering Society. Recently, Kylie has been working with Rising Hearts, an Indigenous-led organization of athlete advocates.

Did your interest in mass spec begin before or after your undergraduate studies at Purdue?

I started focusing on mass spec imaging toward the end of my master's degree, as I was transitioning into my PhD program. I was in a fifth-year master's program, and I began to develop an interest in research and the statistical side of mass spec. Initially, I was drawn to the high-dimensional datasets due to their interesting structures. My father was also a statistician and worked in proteomics. Through him, I was introduced to other statisticians at Purdue. At that time, I saw that Olga Vitek put out an application for a research assistant, and I applied. Olga happened to have a student who worked with Professor Graham Cooks at Purdue. Olga hired me to continue the work the previous student had done in the lab of Graham Cooks—and everything grew from there!

What first sparked your interest in mass spec as it relates to statistics?

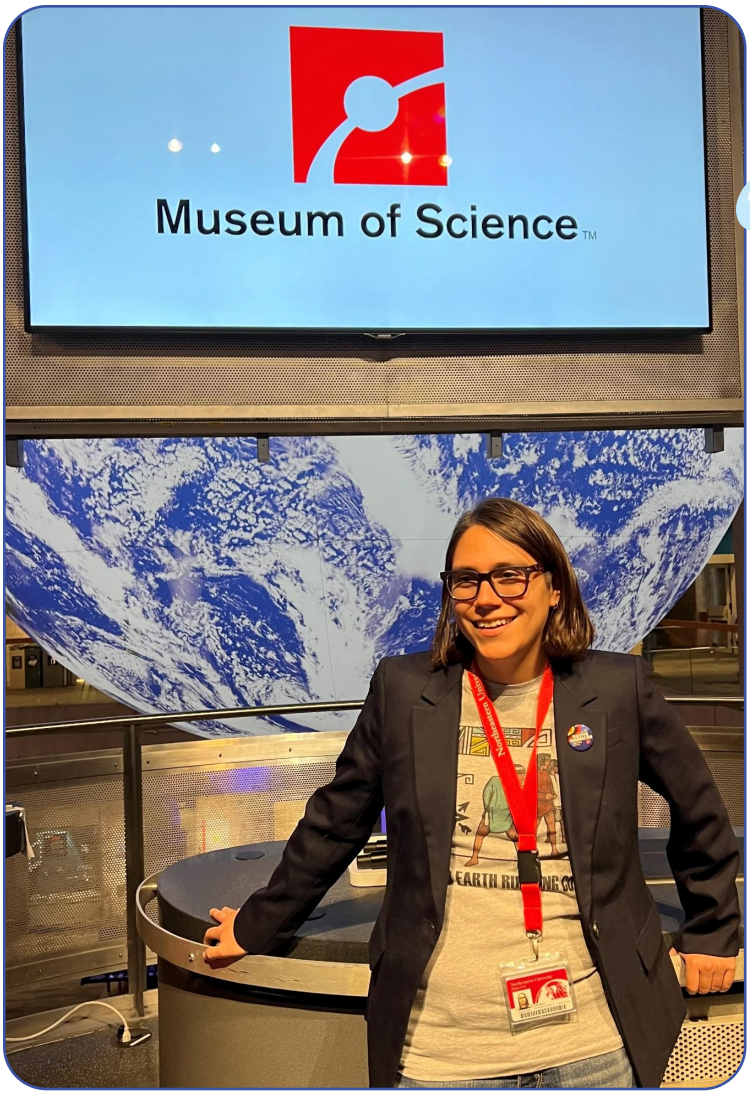
As I touched on, I had a personal interest in statistics—particularly around computational statistics, computational environments, and languages for statistical computing. What really attracted me was the complexity, size, and interesting nature of the problem and how to apply it. I became really interested in the programming side of things, tackling engineering challenges and statistics with complex datasets. I was also thinking about how to build computational systems which account for both the complex biological structures and the needs of statistical modeling, statistical learning, and machine learning.

How did you come to your current position at Northeastern University?

When I was finishing my PhD at Purdue, there was a lot going on in my personal life. I was starting my gender transition, and I was not sure exactly what I wanted to do in my career. My PhD advisor, Olga Vitek, had just been hired to start a master's in data science program Northeastern University in the College of Computer Sciences. I ended up going to Northeastern then, originally as a postdoc. In the beginning, I was doing research and then started teaching within the master's for data science program. From there, I designed some core courses for that program, and that is the path I took to become part of the teaching staff. The faculty at Northeastern have been supportive of my dual role—teaching while simultaneously continuing to do research. I have been lucky to do both.

When did you decide that you wanted to focus on computational mass spectrometry?

It came down to a need for computational statistics and the experience I had in mass spectrometry imaging. It is where I got my start and over time, it has grown on me. When I started in on mass spec imaging, there were very few statisticians working on it, although other parts of our lab had been using more traditional



> *I want my students to really consider what they are doing with data and the people this data is actually serving, because every row of a dataset goes back to a real person with real concerns and needs.*

Kylie Bemis speaking on "AI: Artificial Indigeneity (and Impossible Futures)" at the Boston Museum of Science for Native American Heritage Celebration Weekend in 2024 as part their Meet a Scientist series. (Photo courtesy of Kylie Bemis)

proteomics for a long time. I was fascinated by how interesting, complex, and challenging the computational nature of mass spec imaging was. This allure has been a motivating factor in the work I have done.

We understand that you developed the Cardinal software package. What does this package entail?

Cardinal first came out in 2015, and at that time there were other open-source packages at the time for proteomics and mass spectrometry, yet none of them tackled the specific challenges of mass spec imaging. Prior to developing Cardinal, we ran into difficulties trying to use existing packages and software for imaging-- in terms of scale and computational needs. My PhD was originally going to focus on developing statistical methods, but since there was not anything available at that time for imaging including processing visualization I ended up—by necessity—developing a tool that could encompass all of these elements in one package, and this became the Cardinal—a full workflow of mass spec imaging.

Could you tell us about your outreach among the Native American and transgender community?

In addition to being Native American, I am also a trans woman. I've always been involved in advocacy within the Native American community, and specifically within my Zuni tribe. I was born in Indianapolis, yet my mother and I would always go back to the reservation in New Mexico to see my family—my grandmother, cousins, aunts, and uncles. When I was entering graduate school, I was very aware of my desire to serve the Native American community. At Purdue, I became involved with the Native American Educational and Cultural Center, along with the Purdue chapters of the American Indian Science and Engineering Society (AISES) and the Native American Student Association (NASA). Those communities became like family to me when I was at Purdue, especially when I started my gender transition. When I came here to Northeastern in Boston, I began to come out as myself and this is when I became involved in advocacy within the transgender community. In the past, my involvement was limited to panels at conferences, but in recent years, it has taken on more urgency.

Two shots of Kylie racing the 125th Boston Marathon in support of Missing and Murdered Indigenous People and in loving memory of her relative Jada Gonzales, who was a victim of gun violence in 2022 only months before her high school graduation. (Photo courtesy of Kylie Bemis)

What sorts of lessons have you learned from your role over the years as a teacher and mentor?

As a teacher, I appreciate the varied experiences that my students bring. One of the main reasons I have been able to keep up with the developments in AI—particularly generative AI—has been my role as a teacher and mentor for our capstone projects. One of the courses that I teach in the data science program is our data science capstone in the master's program. In teaching that class, I have been able to see various interesting projects and I have learned from my students about recent developments in the field. Over the past few years, I have come to understand I have a responsibility to instill a sense of ethics in both my own scientific work, in my students and in society in general. This is especially true as we see the ways AI is being used. As an Indigenous person, I am aware of how native people have been studied but have not received the benefits of those studies. I try to help my students realize that they have a responsibility to the people whose data they are analyzing. I want my students to really consider what they are doing with data and the people this data is actually serving, because every row of a dataset goes back to a real person with real concerns and needs.

How has your membership at ASMS helped you to grow and develop as a scientist?

I have been incredibly grateful for the opportunities ASMS has presented. It is always a great thrill to meet other scientists, especially outside of my own area of statistics and computing. I love being in the wider community of chemists, biologists, and other life scientists who are using this data, and who have a greater understanding of the actual experimental study participants. In my own students, I try to instill a respect for domain knowledge, and the people who understand what the data really means. It's especially important for all of us to learn from each other and be able to communicate the importance of the data in terms of the role of statistics. This type of exchange is how we design experiments in a way that accomplishes both the biological goals, as well as the statistical ones. It is about putting all of it together so we can better understand each other, and ASMS has made that possible.

> *It is inspiring to see researchers collaborate, pushing boundaries and creating a significant impact within the analytical community.*

In addition to your scientific work, you are also a published author of fiction. How do you find the time to do both?

Growing up, I was always interested in science, but I also very strongly considered pursuing a more creative path, like creative writing. I decided to get my degree in the sciences, and to continue to pursue writing on the side. I have had two short stories published so far. One was an anthology of fiction by trans women of color. The other one, my favorite, ended up in the Maiden, Mother, Crone: Fantastical Trans Femmes anthology. This story was inspired by the Pueblo revolt, along with the whole history of colonization. I love this story because it is about recapturing and reclaiming one's culture in the face of adversity.

As a Native American member of the Zuni tribe, how does your cultural heritage factor into your writing?

It plays a prominent role in my writing, but in the beginning, it did not. For a long time, I struggled being mixed race; my mother is Zuni, and my father is white. Throughout my undergraduate years, I did not write about my identity. Growing up off the reservation, I felt trapped between two worlds, and I was not sure what role my voice had in those worlds. I believe this had to do with the kinds of literature many of us grew up reading, as well as how the media portrayed Native Americans. Once I began to embrace my culture and write about it, I found my voice, which was powerful. From that point forward, my writing came more from the heart and from my unique cultural lens. My writing has been about embracing the journey and exploring the feeling of being trapped between multiple worlds—and to bridge the cultural gap I experience every day.

Lastly, what do you like to do for fun outside of your work at the university?

Running has always been a passion of mine (Figure 2). In Zuni, running plays a significant role, historically speaking. It was vital during the Pueblo revolt against the Spanish hundreds of years ago. Growing up, my mom was a marathon runner and through her, I learned about distance running. My tribe's runners have always been the carriers of the message. That is how I see running right now. It is especially close to my heart given everything going on with trans women in sports—running has recently played more of a role in my advocacy. I have been working with Rising Hearts, which is an Indigenous-led organization of athlete advocates who are trying to bring together advocacy for the different social justice, environmental, climate, and cultural issues in society. We are looking at how we can use our voices as athletes to bring attention to this kind of work. It has been busy over the past couple of months, so I haven't had as much time to train—but I'm still doing everything I can to keep showing up at the start line!