

FACES OF MASS SPECTROMETRY

Jessica Prenni



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Wide-Open: A Mass Spectrometrist Takes a Circular Path

It does not take long to glimpse the venturesome spirit that shines through Jessica Prenni. She lights up when she speaks of engagement with the natural world, analytical science, and the application of ambient and other new technologies that could shape what we eat, drink, and use for medicine. Because she sees adventure and possibility for innovation all around her, it is easy to envision Prenni in an outdoor setting, immersed in research with a student group beneath a wide-open Colorado sky.

Prenni got her start in mass spectrometry as an undergrad at Southern Oregon University in Ashland, Oregon. From there, Prenni's exploratory nature propelled her along a nontraditional career path. Along the way she landed in a variety of lab settings before she found her true calling as an analytical chemist in a university environment.

After spending years as director of a core research facility at Colorado State University, where the prevailing needs for novel methods and data analysis were in the area of agriculture, Prenni found herself further drawn toward agricultural applications. This experience, paired with a passion for sharing in the adventure of collaborative research with students and colleagues from many different fields of specialization, made it a natural fit for Prenni to transition into her current role as an associate professor in the College of Agricultural Sciences at CSU.

For Prenni, teaching encompasses not only classroom time with students but also direct mentorship of undergraduate and graduate researchers. In the midst of the COVID-19 pandemic, Prenni found that reflecting on the profound impact that she is able to have on the lives and career trajectories of her students imbued her with a sense of optimism that kept her fire burning.

As for her research, Prenni's laboratory reaches across the state of Colorado, as she guides the work that happens in a myriad of locations. Research locales encompass a central lab, fields and greenhouses at CSU, and research plots scattered across the state, reaching as far as the other side of the Rocky Mountains near the Utah-Colorado border.

Whether it is studying the health of soil microbiomes, identifying optimal cultivars, analyzing the quality of agricultural products, or looking at the chemical composition of plants, Prenni and her team strive to meet the challenges entrusted to them by the university and important industry partners. Just as her lab is expansive, so is her work. "Every single project in our lab is collaborative in some way with another research group in the college or with another group outside of CSU."

How were you introduced to the field of mass spectrometry?

While an undergrad at Southern Oregon University, I participated in an internship program at the National Wildlife Forensics Laboratory. I worked on a project that used mass spectrometry to analyze hemoglobin from dried blood spots with the goal of species identification. We would take dried blood spots that had been collected at crime scenes, solubilize the hemoglobin and generate a mass spectrum that could be matched to a library of different species. It was really my first application or experience with mass spec. I did not do mass spectrometry at all as a graduate student, but I decided to go back in that direction in my postdoc.

How did your interest in agriculture get started?

Much of my career has been spent as the Director of a core facility at Colorado state university. In this role while we can pursue our own research projects on the side our primary mission is to support research through the application of mass spectrometry. Being at a land grant university with a strong agricultural college it was only natural that many of our projects were focused in this area. As I made a transition out of the core facility environment I gravitated towards agriculture because I like the applied nature of the research and the fact that an experiment we do in the lab one year can be implemented in the field the next. The agriculture community is also highly collaborative and has a shared goal of focusing on the basic needs of providing food — that's a goal that's easy to get behind.



“Teaching has a different set of challenges than research, but it is very fulfilling.”

Left to right: Jacqueline Chaparro (Research Scientist), Janina Bowen (Graduate Student), and Jessica Prenni “in the field.”

What do you like about teaching? Do you find it to be more or less challenging than research?

My career path has been a bit nontraditional. In my role as director of a core facility I did not do a lot of classroom teaching; most of my teaching was in the context of mentoring undergraduate and graduate researchers directly and then doing guest lectures on specific topics. With my recent transition to a faculty position I have been able to explore teaching in a more traditional classroom setting. Teaching has a different set of challenges than research, which are sometimes less under your control, but it is very fulfilling, and it’s what keeps me going. For me, it has really highlighted how important the students are, defining the reason why we go to work every day, because we have this ability to impact their lives in their career direct trajectories.

How are you applying mass spectrometry to address issues in food/crop safety and quality?

Different cover crops will exude different compounds into the soil, which are going to influence what microbes are there. We’re trying to understand the relationship between these compounds and the soil microbes and how this influences soil health. This understanding could help us develop targeted strategies for more efficient and sustainable agriculture in the future. We can also use mass spec to look at the plant itself. For example, if we challenge plants in some way, like by withholding water or nutrients, how does the plant respond at a molecular scale? If we can understand this it can help to develop crops that are more resistant to challenges or that could thrive with less water or nutrients. Our laboratory has also recently started working on projects related to hemp which is becoming very important for Colorado agriculture. This also represent a natural marriage of agriculture and chemistry as the value of this crop is directly related to its chemical content.

How valuable has attending conferences been to your research and work?

I can’t say enough about the importance of the annual ASMS meeting as an opportunity to reconnect with my friends and colleagues in mass spectrometry, to learn what’s new and to reenergize my passion for science. I really missed seeing everyone this year! I also try to participate in conferences in the food and agriculture space, for example, the American Meat Science Association conference is a meeting I have gone to multiple times and given presentations. Last year, I also went to a great conference in Prague called Recent Advances in Food Analysis. That was much more laboratory-focused, with people doing a lot of the similar things we were doing, using analytical tools to looks at questions

related to assessing food quality and safety. These types of conferences are a great opportunity to build collaborations and to help identify where our tools could solve problems.

How much has your attendance at these conferences influenced the research that’s going on in your lab? What type of research is happening in your lab right now?

Going to conferences and interacting with people at my own university plays a huge role in defining what we do. My goal is finding out how I can add value - and I really rely on my collaborators and colleagues to help me understand what those important questions are. If I had to break down the focus areas of our lab, one is looking at the plant/soil microbiome interactions. I’ve also been involved with a large project that was looking at sorghum, specifically from a biofuel perspective. Another area of the lab would be the use of ambient ionization technologies to evaluate their potential for high throughput screening and agricultural products. The third area would probably be cannabis or hemp research.

What do you like to do outside of work?

I enjoy the great outdoors of Colorado. My family and I are super excited for the winter because we’re avid skiers. In the summer, I do a lot of organized events like road races, biking events, things like that. But since none of that happened this past summer with COVID, we found ourselves doing a lot more of creating our own adventures. I hiked my first 14er this summer, which is a mountain over 14,000 feet. And we did a lot more camping this summer than we had in the past. And paddle boarding — we spent a lot of time on the water this summer too. It was nice.

What led you to where you are now? Did a postdoc change your career path?

In grad school, my research was focused on laser spectroscopy, which involves being in a dark room by yourself with lasers all day. When I finished, I knew I certainly didn’t want to do that anymore. Since I had really enjoyed mass spec as an undergrad, I looked for an opportunity to come back to that in my postdoc which led me to a position at the Scripps Research Institute in La Jolla working for Dr. Gary Suizdak. It was my first exposure to proteomics and omics technology in general. I ended up taking almost a year off with the birth of my first child and we moved back to Colorado. I was able to leverage what I had learned during my postdoc and say, “I can bring this to CSU.” With my postdoc, I made a lot of strong connections and met colleagues and friends that have impacted my career in multiple ways.