Who will be the next Face of Mass Spectrometry? Nominate a member who exemplifies diversity of ASMS (nationality, ethnicity, age, etc.) and path to a career in mass spectrometry.

Laura Sanchez

Anne Brenner and Hayes Simpson are sciences writers at Technica Editorial

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Inquisitive Mind: Venturing into New Territories

Laura Sanchez—Associate Professor of Chemistry and Biochemistry at the University of California, Santa Cruz—delves right into conversation, with an unwavering candor that indicates she is ready to engage in any question that comes her way.

Having grown up in the delta region of California, Sanchez headed north for college, where she was surrounded by wheat fields in Washington state. Undergraduate involvement in organic chemistry led to an internship that serendipitously had a minor focus on chemistry and a major concentration on marine creatures.

While exploring natural products yielded by the sea on the California coast, Sanchez zeroed in on the connection between chemistry and natural products research and ran with it. Her fascination with marine-derived medicinal products led Sanchez to postdoc work at UC San Diego, where she entered the field of mass spectrometry.

From the dawning of her career in medicinal chemistry, Sanchez committed herself to interdisciplinary fields of research. Her drive to integrate natural products research with medicinal chemistry and drug discovery brought the relevance of mass spectrometry into focus for Sanchez. By the end of her postdoc journey, she had established a distinctive academic discipline.

Sanchez's background with finding parallels between different areas of biological and chemical science has aided in her keen ability to integrate and guide multiple research projects simultaneously. She greatly enjoys leading students in collaborative troubleshooting and problem-solving to find answers.

It is discovery of the unknown that compels meaningful scientific studies, in her firm opinion. This perspective is the reason why Sanchez does not use a mass spectrometer to examine objects expected to support a known theory or established research, but rather prefers to focus on phenomenon that have not been extensively explored.

With a proclivity to venture into new territories, Sanchez found herself drawn to teach not only university students but also younger learners who are being introduced to the sciences. Having pep that is contagious and invigorating and a penchant for hands-on learning, Sanchez is a magnet for inquisitive minds and well suited for elementary education, as well as higher learning.

Communicating with a broad range of students has contributed to Sanchez's ability to reconstitute scientific jargon and clearly communicate scientific applications, methodology, and relevance of research to her target audience.

The California coast recently beckoned Sanchez back again. The Sanchez Lab has relocated to UC Santa Cruz after five years at the University of Illinois at Chicago. With a big move behind her and unchartered territory ahead including a vast ocean teeming with microbial life, the horizon looks bright.

What drew you to science?

In my junior year at Whitman College in Walla Walla, Washington, I never had plans to stay in academia. But I was teaching for my organic chemistry professor, and he said, "You're actually really good at this, I think you should do a summer internship somewhere." So I spent my summer working in a lab at UC Santa Cruz. Then, I went back there for my Ph.D. and I did a lot of medicinal chemistry. So I'm not a mass spectrometry specialist by training. I did do more mass spectrometry in my postdoc, with Pieter Dorrestein at UC San Diego. I went to his lab because I thought the imaging mass spectrometry they were doing on bacteria would be a good way to bridge my research in natural products and medicinal chemistry with more informed drug discovery. Now, I run a research program that has a mish mosh of all of it together—we do aspects of natural product chemical ecology, at the interface of mass spectrometry. It's kind of a weird program, different from most, but that's why I like it.

"I like working on diseases that don't get much press, or there aren't as many resources dedicated to them, because I think that's where academia actually stands a chance to make a difference."

Drs. Katherine Zink, Laura Sanchez, and Joanna Burdette (from left to right) visually inspect the co-cultures of murine oviductal epithelial cells grown with an ex-plant ovary prior to matrix application for imaging mass spectrometry.

What are some of the natural products that you have helped to develop?

We've done the most small molecule work on our cheese rinds, bacteria, and fungi. Cheese rinds, for instance, are actually really stable worldwide, and the same microbes always end up on the rinds at the end of a two-month aging process—but they're not actually ever put there. We can grow these microbes in the lab on solid substrates. Then, we can control elements like the salt content, pH, and humidity to help answer the questions about how microbes got there and what they produce over time. We also like to look at bacteria in animals, such as Vibrio cholera in the intestines of a zebrafish. Vibrio cholera is the causative agent of the cholera illness. That's really interesting because zebrafish can be found in and around the Indian Ocean, which is where cholera is still seasonally endemic. So, cholera is really good at colonizing the gut of zebrafish. But we don't really know why these organisms have preferences for these certain environments; how are they able to persist and survive there? We argue that it's the chemistry, which is why we need mass spectrometry.

Are there any specific diseases to which you hope your research will one day contribute a cure?

I like working on diseases that don't get much press, or there aren't as many resources dedicated to them, because I think that's where academia actually stands a chance to make a difference. I think that's where if you are working on things that are a little bit understudied, it makes the research a little more worthwhile. For example, with ovarian cancer, there's a low five-year survival rate, but there's less research because only women get it. Interestingly, even the term "ovarian cancer" might be a bit outdated, because we know now that it comes from the fallopian tube in most cases. I think it's about understanding how, where, and when some of these diseases start.

Do you usually have many studies going on in different areas? Or does your lab usually focus on one thing at a time?

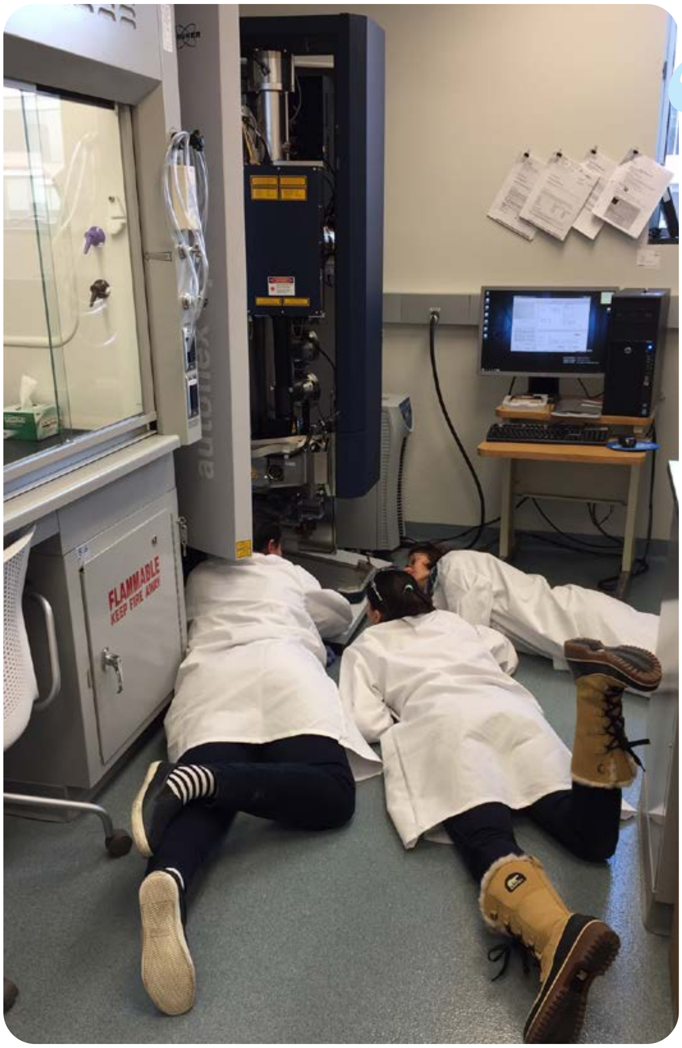
Everybody training with me is learning the same skillset. We're all using mass spectrometry and analytical chemistry to identify chemicals, but everybody has their own biological problem. I think that decreases competition among the mentees. So, if one person is working on squids, and one person is working on cancer, but you find a common troubleshooting error, the students are more likely to help one another, instead of saying, "Okay, we're both going neck and neck on this, and we're going to fight it out." To me, we're all trying to answer the same questions, just in different settings; we have, for example, "Team Cheese" and "Team Ovary." We're really into understanding chemical communication.

How do you network and collaborate with mass spectrometrists at other universities?

Conferences are the main way I communicate. When asked about collaborations, I like the challenge of the unknown; if you expect something to be there, I'll usually send the researcher somewhere else or suggest an alternative method. I work closely with Bruker Daltonics and they have hosted me as a keynote speaker at Iowa State University and in Japan and Korea, where I gave a weeklong set of talks to network with other mass spectrometrists across the world. That's the furthest I've ever been, and that was super fun—definitely a whirlwind trip.

What was the process that you think led you to become a good science communicator?

Probably because no one in my family is a scientist—my mom's a paralegal and my dad's a carpenter. In order to talk to family and friends, you have to be able to communicate, so I've had a lot of practice over the years, when my parents and my grandparents have wanted to know what I was doing. I have to



We're not making new mass spectrometers, but I think the field advances when new doors to biological applications are opened.

Laura shows two graduate students how to clean the source on the in-house Bruker Autoflex Speed LRF mass spectrometer.

find a normal way to say it. And in my graduate career, I did a lot of K-12 outreach. It's very important to work with kids early. To talk to a room full of third graders, you can't use any jargon, or they're instantly lost!

When teaching young children, what formats do you use?

It's a lot of hands-on learning, such as one activity where we got about eight different cheeses. We gave everybody time to taste, smell, and compare everything, and they wrote down observations. The next week, they rubbed them on ager plates. In theory, none of the processed cheese was supposed to grow anything; the unpasteurized fancy cheeses have bacteria and fungi on their rinds, so they should grow things. We said, "If we told you something was alive, which ones would you guess and why?" It gets them thinking about the difference between a fermented food and a processed food. The next week, we came back with a whole new set of paired foods, like apple juice versus cider or pickles versus cucumbers, and we had them make predictions about which pairings were alive. They all pretty much nailed it, saying "these ones, because of these properties." It's a lot of work, but the goal is clear, and kids aren't able to do a whole day of lecturing.

How has your work in mass spectrometry changed the field?

We're really interested in the biological applications—we spend a lot of time adapting our biological systems to be compatible with the mass spectrometry measurements. We're not making new mass spectrometers, but I think the field advances when new doors to biological applications are opened. Like ovarian cancer, if you're at the point where you have a tumor, it's too late. We wanted to know what signaling happens before you get the tumor. We adapted our biological system to answer that question, which is a totally different kind of question. We've probably put the weirdest things into the instruments compared to anyone else: squids, zebrafish intestines, and even a piece of cheese. I'll put anything in the mass spectrometer at least once!