FACES OF MASS SPECTROMETRY / Asher Newsome

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November 2022

Tell Them What You Think

Asher Newsome's positive outlook toward both the challenges and successes of his career is easily felt when he discusses his evolution in the field of mass spec. After earning a doctorate in chemistry from the University of North Carolina at Chapel Hill in 2009, his postdoctoral work brought him to the FDA Center for Food Safety and Applied Nutrition, in the first in a series of jobs in government labs.

While his arrival at the Smithsonian Institution came about after being laid off as a government contractor, it has become a "dream job" for him. In his current role, Asher works alongside curators and conservators across the Smithsonian Institution system. The artifacts he samples range from relics of antiquity to modern pop culture objects.

Recently, he deployed for the first time a system of his own design to use on collections objects. The system can conduct minimally invasive sampling on large, intact objects. One of his hopes with this work is to show cultural heritage communities involved with the Smithsonian Institution the value of ambient analysis techniques.

Asher advises those getting their start in mass spec to keep an open mind toward new experiences and stay adaptable. One quote he works by comes from the film The Hunt for Red October: "…Give 'em direct answers. Tell them what you think." When balancing matters of culture and conservation with science—as Asher does so often in his work—candor is definitely advisable.

How did you get started in mass spec? Did it begin in school?

My interests in mass spectrometry and analytical chemistry come from a linear progression. In high school, I took every science class available, which were mostly biology classes. I'm from a small town in Georgia, and there were, I suppose, fewer academic opportunities in high school than most places have. But I took what science opportunities there were. When it came time to pick an undergraduate major at the University of Georgia, I chose chemistry almost as a next logical progression. Then, I found specifically in organic chemistry that I really liked "mixed spectroscopy" problems, where the goal was to identify the molecule based on IR, proton NMR, and EI mass spectra. I also liked my instrumental analysis class, so I started working toward that area and later took Jon Amster's mass spectrometry class along with classes in NMR and analytical spectroscopy. My undergrad research advisor, Tim Dore, suggested I apply to the UNC analytical chemistry program for grad school, because it was ranked the best at the time. There, I interviewed around and ultimately joined Gary Glish's mass spectrometry lab.

What brought you to the Smithsonian Institution?

That is also a product of my career progression. "Career evolution" is a good way to describe it—it was a series of circumstances. After focusing on ion trap instrumentation and fundamentals in my PhD, I wanted to "see how the other 99% live" and use chromatography. My postdoc, which brought me to Maryland, was at the FDA Center for Food Safety and Applied Nutrition, building an LCMS assay for food allergens in baked goods and learning about sample preparation. After that, I was a contractor to the U.S. Naval Research Laboratory (NRL) for another sea change in applications, using ambient ionization methods and GCMS to study explosives. Then funding ran out, I got laid off. Late 2016, a position at the Smithsonian Museum Conservation Institute (MCI) was posted to USAJobs. I think they liked that I had such a wide background and expected that I would be comfortable setting up instrumentation that hadn't been used for a few years. Certainly, it was a "right place at the right time" situation. had the experience to get me in the door, and it has been a very happy place for me to be ever since.

How do food allergies relate to mass spec?

Food creates a major cultural exchange and socialization between people. So, when people can't share in food because of allergies, there's a real dividing line there. What we were doing in building that assay I mentioned was looking for the proteins

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Carefully positioning a 20" wide basket with a lid (circa 1880, NMAI #090037.000) for minimally invasive, non-proximate sampling to identify the dyes on various splints: the first deployment of the new ambient MS system. (Photo courtesy of Asher Newsome.)

in the very complex matrix that is food. Specifically, we were looking for the casein proteins in dairy milk. Imagine everything that goes into the recipe of a cookie—there's sugar, there's salt, and there's fat, among many other ingredients. And that's just for a basic cookie. That's before you add things like chocolate, which can make things even more convoluted. At the FDA, we would sort of jokingly talk about the fact that a big focus of clinical assay development is looking for analytes in human blood—but while blood itself is a complicated matrix, blood is basically always blood. Foods, on the other hand, can be wildly different. As complex as it was, it was also a very interesting area, although it's one that I'm not working in anymore.

What are you working on now?

Because the Smithsonian is so large—including divisions for natural history, air and space, American art, African American history and culture, and so many other fields—all sorts of things come my way from Smithsonian curators and conservators. I also regularly collaborate with other museums and other people in the government. Right now, I have copies of the solid phase microextraction direct analysis in real time (DART) interface I designed while I was on loan to an industry lab and a government lab. So, I have a ton of projects going at all times, both long term and short term. Sometimes I am asked to study the materials used to store an object or construct an exhibit—the sort of behind-the-scenes work that can involve some fascinating chemistry. I give a lot of tours of the lab, and often someone will ask, "What's the oldest thing you've studied?" That would be fibers from a ~2000-year-old Egyptian doll. It's also very cool to work on objects from pop culture, like a pair of ruby slippers from The Wizard of Oz, but I am most personally invested in the technical aspects.

I have an ongoing interest in minimally-invasive sampling from large, intact objects. If an object is too big to fit right next to your mass spec, and too precious or culturally sensitive to allow for any kind of sampling that is going to leave a mark, there has been little recourse for mass spectrometry. I just barely got away with a wooden hat analysis, sacrificing orders of magnitude of ion transmission to reach the sample surface. Now, a couple of years on, I have built a system that uses a carefully optimized pulse of neutral heated gas and transports analytes two meters to an ion source and MS. That was very recently deployed on collections objects for the first time to identify dyes on a group of baskets for the National Museum of the American Indian (Figure 1), and I look forward to publishing it soon.

When, and how, did you decide to focus on analytes and instrumentation in your work?

I really got hooked in grad school. Gary Glish had already put me on an ion trap photodissociation project, which was great, because lasers are cool. Then, I had an idea to turn the system on its head—resonantly excite ions into an off-center laser, to better trap the product ions that form and relax out of the laser path. I was so hooked that I thought about it for years—even after we published it and the field moved on to UV lasers and linear ion traps. Grad school was also my first experience with machining and machine diagrams. I was tasked with building an aerosol introduction system onto an ion trap, and that is how I discovered the pleasure of putting together components you have designed yourself and having everything fit within spec on the first try. I got to revisit that at NRL, which is also where I started working with chemical ionization (CI) at atmospheric pressure and in the gas phase. Now, at the Smithsonian, I get to do more than ever, using ambient ionization methodology as my primary workhorse and also building new sampling systems.

Tell us about some of your work with ambient ionization and CI?

My first experience with ambient ionization was at NRL, using a post-plasma ionization method, flowing atmospheric pressure afterglow. I was looking at a sample of a nasty peroxide explosive in the winter soon after I started, but when I got back to the project a few months later, the spectrum looked different. This was

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in the restricted explosives handling lab, which had environmental monitoring, and I figured out that it was the change in ambient humidity that produced the effect. So, I started looking at various analytes in different conditions. I even built a box around the source region to manipulate the conditions and brought in a DART source from Luke Ackerman at the FDA.

Later, at NRL, I was trying to port over some other chemistry from atmospheric pressure to a GCMS and not doing very well. So, I switched over to conventional methane CI and started collecting data, but the CI gasses had mixed in the ionization region and made the chemistry more efficient. By that time, I had also tried CI with isobutane, and I found out firsthand how quickly it fouls the source. That fact was extremely underreported in the literature, even though isobutane produces much less analyte fragmentation. From there, I figured out that you could do CI with isobutane diluted in an argon make-up gas and avoid source fouling and instrument variation. I was fortunate to show Burnaby Munson this work, and he was as sweet and complimentary as could be. At the Smithsonian, DART-MS has become my go-to analysis tool, for which I have tested multiple additions and variations.

How has your work helped with conservation efforts?

It can be difficult to pinpoint specific impact sometimes. If a small project comes to me through a conservator, they usually tell me the backstory, but I don't necessarily have the time to follow up after I've given them the answers they need. Perhaps my analysis lets them pick an exhibit material that prevents some degradation years down the road. I have ambitions of building systems and spectral libraries that will make these questions easier. Other conservation efforts are years-long projects, like mitigation efforts against efflorescence build-up in glass cases that will be relevant to museums around the world. For example, if I'm trying to help a curator or a conservator select appropriate material for placing collections of objects on display, there will be some chemistry in between those objects and also some interplay between the materials that are used to construct the exhibit. We want to attempt to project that impact months, years, and perhaps even decades down the line. There's a whole field that's dedicated to this type of work called preventive conservation. For me, it is very gratifying to meet the people who are personally and/or culturally invested in the projects, like the Tlinget artists from the wooden hat repatriation, and the Native American basketry gathering group who were willing to try my new minimally invasive technique. I hope my work will show the cultural heritage community at large the value of ambient sampling and ionization MS techniques. There is a gray area between destructive analysis and nondestructive analysis that can be extremely valuable.

Reaching up to catch an ultimate frisbee disk. All my best plays happen off-camera, I swear! (Photo courtesy of Asher Newsome.)

What has been the biggest challenge of your career, either specifically working in mass spec or generally as a scientist?

I am extremely fortunate. It was rather challenging to move between research topics as I have done, but it was ultimately to my benefit. As I mentioned, I got laid off, and being laid off is hard on anyone, but I was able to wait out unemployment to finally get my dream job without having to move. ASMS has been important to me since almost the beginning of my career. I met John Callahan while I was in grad school—either at ASMS or at an ASMS planning meeting while Gary Glish was president of the society—and I asked him what it was like to work for the government. Later, it was his branch at the FDA that I joined as a postdoc. Equally important to my career has been my involvement with the Washington-Baltimore Mass Spectrometry Discussion Group (WBMSDG), which has kept me in touch with many mass spectrometrists in the region. ASMS and WBMSDG became particularly important to me when I became a contractor and was for the first time the only mass spectrometrist in my group.

What are your interests outside of the lab? Do you have any hobbies or passions that you enjoy pursuing when you're not working?

Year-round, I play one to three games of ultimate frisbee a week, depending on the season, so that burns a lot of energy. I play strictly pickup games, so there is usually no one being hypercompetitive the way one often encounters in league play—I'm there to make plays but more importantly to have fun. I also enjoy biking and have a handcycle, which is an arm-powered

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Biking around the Kinderdijk in the Netherlands before the 2022 International Mass Spectrometry Conference. (Photo courtesy of Asher Newsome.)

three-wheeled cycle, that I used to race in marathons. In 2020 I started doing long rides on the metro DC trail system. A seasonal hobby for me is gardening. My wife and I keep a large vegetable garden, and it is nice to be able to give produce to friends and family. My father and grandfather had gardens during their whole lives, and as a kid, I was made to work in the garden, whether I wanted to or not—so, I'm a little surprised to now actually want to do it myself. But it is nice to have the butterbeans and cowpeas that I grew up with.

What advice would you give to someone starting out in mass spec?

I think the most important thing is to keep an open mind, because life circumstances can be complicated. You might have to change jobs because, for instance, your spouse changes jobs and you must move with them, or funding runs out. Or, maybe your application area becomes outmoded, because science marches on. So, always be prepared to think about new problems and embrace new situations. There are many people to learn from, and I have been taught by so many—from my labmates and advisor in the Glish lab, to Peter Scholl at the FDA, to the senior conservators at MCI. I have two favorite pieces of advice. One came from Desmond Kaplan after he graduated a few years before me: "Champion your work." You've got to be able demonstrate why your research is important and valuable, both through writing and in person, and that takes practice. The other comes from The Hunt for Red October; the character played by James Earl Jones advises the protagonist, who has to give a surprise briefing to VIPs, "Look, no one understands this material better than you…[they're] liable to ask some direct questions. Give 'em direct answers. Tell them what you think."