

FACES OF MASS SPECTROMETRY

Jace Jones



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Assembling a Chemical Jigsaw Puzzle

When Jace Jones—currently an Assistant Professor in the University of Maryland's School of Pharmacy—describes the fundamental curiosity that binds and cements his research interests, words flow quickly and seamlessly in a sudden burst.

"I am really interested in the instrumentation side of things, including ionization and tandem mass spectrometry, where you have a particular molecule of interest, get it in the gas phase, and then break it apart," he explains. "It is then that you can start to piece together the individual parts into what the actual puzzle looks like—by knowing the chemistry!"

Focusing on lipids and small molecules, Jones has assembled a core research program in mass spectrometry that focuses on illuminating pharmacological solutions to human health in areas that include traumatic brain injury, liver toxicity, and infectious disease. But his career trajectory that led him to his own research lab is unusual when compared to many with tenure-track positions. After completing his undergraduate degree from Whitworth University (2000) and his doctorate from the University of Washington (2009), he worked outside of academia—in industry—analyzing environmental contaminants. En route to his current position, he had an abbreviated post doc and then spent four years managing a Mass Spectrometry Center when he first moved to Baltimore.

Two years ago, in 2018, his job at UMB transitioned to a tenure-track position.

"We are all, as scientists, crunched for time, but meandering a little bit can provide some unique insights. For me, it was important to have time to experiment and try different things," he says.

His experimental, circuitous route is now paying off: earlier this year, he received the American Society of Mass Spectrometry Research Award and the American Association of Colleges of Pharmacy New Investigator Award.

What sparked your interest in science and mass spectrometry?

When I was a freshman in high school, I had a cornea abrasion that became infected with *Pseudomonas aeruginosa*, a common Gram negative bacteria. Long story short, the infection was stopped with antibiotics and vision was restored with a cornea transplant. This involved a lot of interesting chemistry and biology, so I thought, "Oh, wow. Science is pretty cool!"

I realized that I liked analytical chemistry when I had a summer internship—and then a job after my undergraduate degree—with my Uncle Steve's company, Jones Environmental, Inc., in Southern California. I was identifying volatile organic compounds like benzene in groundwater and soil. I really enjoyed having the confidence to identify unknown analytes.

What did you research for your doctorate?

My PhD work at the University of Washington, under Frank Tureček, involved a heavy dose of gas-phase ion chemistry and applied mass spectrometry. My first project involved investigating peptide fragmentation mechanisms with energetic electrons (Jones, J. W. et al. *J. Am. Soc. Mass Spectrom.* 2007, **18**, 432–444; Tureček, F. et al. *J. Am. Chem. Soc.* 2008, **5**, 114584–96). Then, switching gears, I started looking at bacterial glycolipids, specifically lipid A, in collaboration with David R. Goodlett at the School of Pharmacy. Lipid A serves as the hydrophobic anchor membrane of lipopolysaccharide (LPS) and is a key recognition molecule for the mammalian immune system. We were interested in structurally characterizing lipid A from *Yersinia pestis*, the causative agent of the black plague, in order to investigate how the bacteria can modulate its lipid structure to either evade host detection or exacerbate the host's inflammatory response (Jones, J. W. et al. *Proc. Natl. Acad. Sci. U. S. A.* 2008, **105**, 12742–12747; Jones, J. W. et al. *J. Am. Soc. Mass Spectrom.* 2010, **21**, 785–799).

What was your path after your doctorate?

Well, the plan was to get my Ph.D. and go back to the family business, so I went back to Jones Environmental, Inc. as the technical director of the company. I learned a lot about running a small business. I was not only doing some of the analyses, but also report writing, management, and interfacing with clients.



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Left to right: Jace Jones and graduate students Yulemni Morel and Anh Tran.

But, I missed basic research. So, after a couple years, I moved to Baltimore to work in a dual role as a research scientist with Maureen A. Kane and as a manager of the newly renovated mass spectrometry center at the UMB School of Pharmacy. I was able to get back into research and gain valuable exposure to high-end instrumentation. A lot of my initial work focused on small molecule quantification: we developed chromatography and mass spectrometry techniques to confidently quantify small molecules in a variety of biological systems. In one project, we worked on an antiseizure drug called lamotrigine because anecdotal and clinical data suggested that the generics just did not work as well as the brand name. But our double-blind study found that the metabolism of the generic pill actually matched the brand name in efficacy (Ting, T. Y. et al. *Epilepsia* 2015, **56**, 1415–24). On another project, we developed a targeted MS3 quantitative assay, referred to as MRM3, for vitamin A metabolites (Jones, J. W. et al. *Anal. Chem.* 2015, **87**, 3222–3230; Byrareddy, S. N. *Science* 2016, **354**, 197–202). In addition to the small molecule quantitation work, I developed mass spectrometry-based techniques for lipid structure characterization in several different animal model systems (Jones, J. W. *J. Mass Spectrom.* 2015, **50**, 1327–1339; Jones, J. W. et al. *Biomed. Chromatogr.* 2017, **31**; Jones, J. W. et al. *Pharm. Res.* 2017, **34**, 2698–2709; Jones, J. W. et al. *Proteomics* 2019, **19**).

What challenges did you face?

I think in academics, we tend to regard the path to an independent faculty position as one that requires an exclusive academic track that, in most aspects, is an effective training mechanism. But, there are a lot of talented, smart people who have chosen a different path. For me, the crossover from industry back to academia was challenging yet provided valuable “real-life” experiences that are not easily captured on a Biosketch. Ultimately, it was not until I returned to academic research that I realized that I wanted to be a Principle Investigator. The next step was figuring out how to get there.

After several years of mentorship, publications, and numerous iterations of a research statement, I transitioned to a tenure-track job and started my independent lab. Currently, I have two graduate students and a postdoc coming on-board. Being a mentor is pretty exciting. I’ve benefited from some fantastic mentors, and I hope that I can provide that type of mentorship to the folks in my lab. Science is not a solitary endeavor; it should not

be done alone. It is fun to have people in the lab who are not only smart and talented but a joy to be around. I am happy to go to work every day.

My primary teaching responsibilities involve teaching pharmaceutical and physical chemistry to first year PharmD students. The goal is to inspire and engage students with material that does not always seem applicable to a practicing pharmacist. This is a challenge, but it is enjoyable. It is fun to see when a connection is made, and the students do well.

What research excites you now?

I am very excited about the use of mass spectrometry to link lipid structure to quantitative abundance. Ultimately, we are interested in how lipid structure and abundance affect biological function. We think mass spectrometry is a great way to pursue this.

One project that I have carried over from my previous research position is looking at lipid markers of traumatic brain injury. The goal is to identify lipid markers that could be diagnostic of the brain injury and informative for therapeutic intervention.

Another project in the lab is focused on sphingolipid metabolism as a diagnostic marker of hepatotoxicity in drug-induced liver injury. We are developing mass spectrometry-based platforms to characterize sphingolipid structure, anchor structure to quantitative abundance, and develop 3-dimensional sphingolipid metabolism maps.

A third project recently started in the lab is focused on investigating the lipid composition of the viral envelope. Enveloped viruses are particularly prone to cause illness, death, and economic distress worldwide, as clearly seen with SARS-CoV-2 (the virus responsible for COVID-19). We are pursuing the use of mass spectrometry-based techniques to define the lipid composition of the viral envelope to gain fundamental insight into viral replication and transmission.

What do you enjoy outside of the lab?

Admittedly, most of my time is at work. But outside of work, my time is spent hanging out with my family. My wife and I have three kids—an 11-year-old and nine-year old twins—and we do a lot of sports, hiking, reading, and neighborhood activities. I think it is a decent balance.