

FACES OF
MASS SPECTROMETRYBoniek
Gontijo Vaz

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Origins, Journeys, and Transformations

Boniek Gontijo Vaz is associate professor at the Federal University of Goiás in Brazil, where he coordinates the Laboratory of Chromatography and Mass Spectrometry. His research interests include petroleum and petroleomics, organic geochemistry, and chemical imaging. He was recently elected as an affiliate member of the Brazilian Academy of Sciences. He is also the president of the Latin American Association of Organic Geochemistry and an associate editor for *Química Nova*, a publication of the Brazilian Chemical Society.

Boniek's passion for the sciences developed at an early age, alongside his deep appreciation for the natural world. He began to seriously explore the realm of mass spectrometry after joining ThoMSon Mass Spectrometry Laboratory at Brazil's University of Campinas to pursue his PhD. While there, his research focused on the characterization of organic compounds using FT-ICR MS equipment. What excites Boniek about his present work is its complexity. He likens the research process to the job of a molecular detective—investigating organic compounds to decipher their origins, journeys, and transformations. A current objective for Boniek is the development of novel isotopic analysis methods that harness the power of high-resolution mass spectrometry.

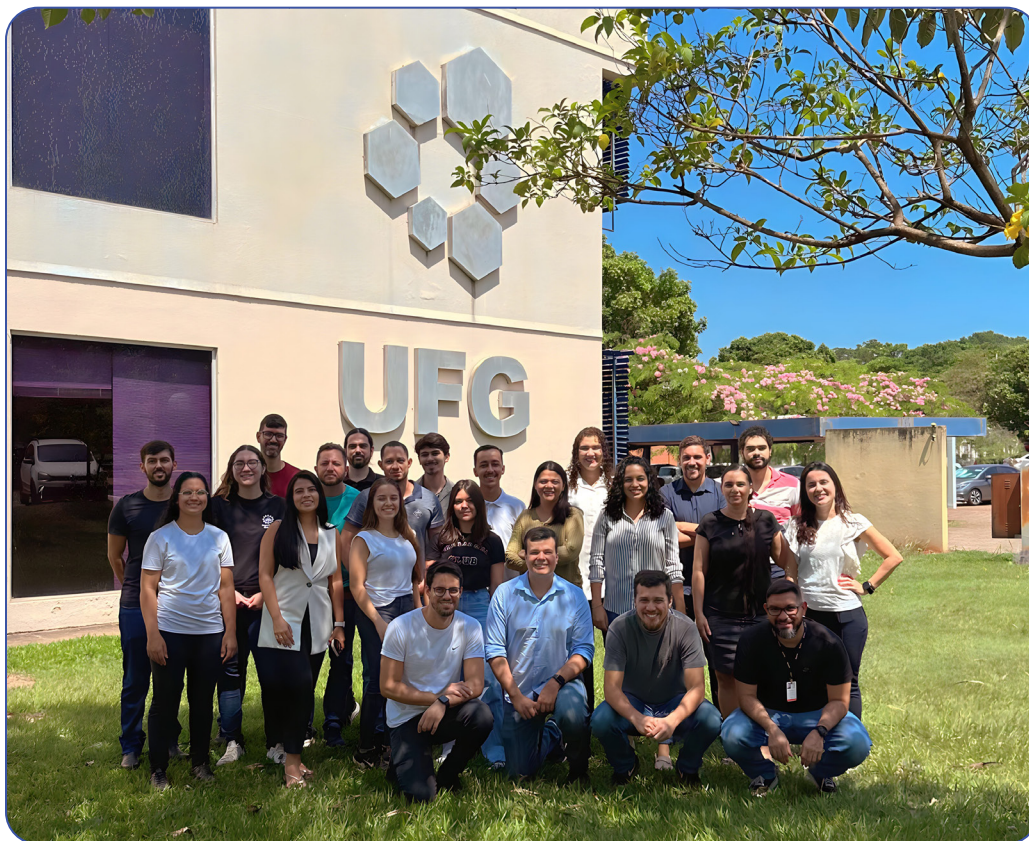
Becoming a professor was a meaningful milestone for Boniek. As an educator, he values the opportunity to inspire growth for his students, and he enjoys seeing them succeed. His advice to young scientists is to follow their passion and stay committed to their individual interests and aspirations

How did you get your start in mass spec? Was it in the United States or in Brazil?

I began my journey into the fascinating world of mass spectrometry in Brazil. It started during my undergraduate chemistry studies at the Federal University of São Carlos, UFSCar. At that time, I was focused on organic synthesis but used mass spectrometry to characterize the compounds I synthesized. Specifically, I worked with a GC-MS with an EI source. I would say it was love at first sight. I was deeply intrigued by mass spectrum interpretation, fragmentation studies, and the like. Since I didn't have access to more advanced techniques at UFSCar, I sought out the most renowned group in the field at the time: ThoMSon at UNICAMP, Campinas in Brazil. Under the guidance of Prof. Dr. Marcos Eberlin, to whom I owe so much and who taught me a great deal, I truly delved into the realm of mass spectrometry. At ThoMSon, I ventured into various areas of the field. I started with investigating organic reaction mechanisms using ESI-MS, transitioned to forensic chemistry applications, and ultimately focused on analyzing complex mixtures, like petroleum, using the FT-ICR MS technique—a field I continue to work in.

Can you tell us about when realized you'd like to become a scientist? Was it at a young age? Or are there any formative experiences that you'd like to share?

I grew up in Buritis, a small town in the state of Minas Gerais, Brazil, on a farm. From a very young age, I was always curious, constantly questioning and seeking to understand the "why" behind things. At our home, we had this large cashew tree, under which I'd play and observe the world. This tree produced resins on its trunk, and I always wondered why it produced them while most other plants didn't. I was curious about what these resins were made of. Interestingly, whenever I received toys as gifts, I had this peculiar habit of trying to take them apart to see how they were constructed and what was inside. Perhaps that's where my calling to be a scientist was born, largely driven by my innate curiosity. However, my passion for the chemical sciences was solidified in high school during my first chemistry classes. I was certain even back then that I wanted to study chemistry. What later shaped me was the conducive scientific environment I found during my undergraduate studies at UFSCar and UNICAMP. Especially during



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Professor Boniek's research group at UFG's Samambaia Campus, Goiânia – Brazil. (Photo courtesy of Boniek Gontijo Vaz.)

my master's and PhD studies, I had the chance to engage in numerous research projects, which further cemented my decision to pursue this career path.

When, and how, did you decide to focus specifically on petroleum studies and organic geochemistry?

During my PhD journey, I took a deep dive into the world of mass spectrometry. It was a time of innovation for us at Unicamp, as we were among the first in Brazil to get our hands on the FT-ICR MS equipment. Teaming up with Petrobras, we plunged into the intricate terrains of petroleomics and organic geochemistry. At its heart, organic geochemistry explores the life cycle of organic compounds on Earth—their origins, journeys, and transformations. Our mission often felt like piecing together age-old tales that span millions of years, all narrated by the molecules we deciphered using mass spectrometry. It's a thrilling endeavor! We operate like molecular detectives, and every new challenge pushes us to adapt, innovate, and redefine our mass spectrometry techniques. Furthermore, the world of organic geochemistry introduced me to some incredible individuals, fostering friendships and forming some of my most cherished collaborations.

When, and how, did you decide to focus on teaching at the graduate level? What are some of the rewarding aspects of being an educator?

When I was doing my undergraduate and graduate studies, my milestone goal was to get a position as a professor—but at the time, it seemed like a faraway dream. I've always been drawn to the idea of transformation, and chemistry epitomizes that for me.

So, when it came to choosing a career path, the decision to be an educator was a natural extension of my love for this science. It's all about sparking change, and as teachers, we're in this unique position to ignite these transformations within our students. Teaching at the graduate level brings its own set of joys. I get to engage with students from varied walks of life, each with their unique perspectives. It's like a dance—I guide, challenge, and mold them, all while learning and growing myself. But if I had to pick the most rewarding part of it all, it would be seeing my students flourish. At my current position at Federal University of Goiás, located at the center of Brazil, I am so fortunate to have brilliant students. There's nothing quite like the pride and joy that comes from watching a former pupil soar high in their chosen field.

Is there a specific advancement in the field of mass spec analysis that has significantly influenced your research?

Absolutely! The world of mass spectrometry has seen some remarkable advancements in recent years, and these have left an indelible mark on the direction and scope of my research. A standout development in this domain has been the introduction of new ICR cells, with the “paracell” being particularly notable. This cell offers an unparalleled stability over an extensive ion range, yielding a resolution that far outstrips traditional detection methods. With this heightened stability, we can delve deeper and recount the intricate histories of complex mixtures with greater precision. Whether it's petroleum, natural product extracts, or dissolved organic material—all of which are staples in our routine research—the enhanced capabilities allow us to understand these substances on an unprecedented level.



“For young scientists venturing into the realm of mass spectrometry, here’s my advice: Let passion be your guide. When you wholeheartedly commit and immerse yourself in your work, success inevitably finds its way to you.”

Members of Professor Boniek’s team alongside the Bruker 7T FT-ICR mass spectrometer, where research about complex mixtures is conducted with special emphasis on petroleum studies. From the left to right: Danielle Mitze, Marcela Rodrigues, Boniek Gontijo, Joveilton Batista, Gabriel Henry, and Gesiane Lima. (Photo courtesy of Boniek Gontijo Vaz.)

Another line of research that has demand and impact is the innovation in ambient ionization sources. The rise of the paper spray technique, for instance, is not merely a new method, but it also represents a potential paradigm shift in how we approach ionization. With paper spray, I’m not just content with adopting the technique—we’re also deeply invested in refining it. Our primary objectives revolve around enhancing two critical parameters: sensitivity and specificity. These become even more crucial when we delve into our central research focus of probing targets that reside within highly complex mixtures. Navigating this intricate landscape requires precision, and the new tools and techniques at our disposal are paving the way for groundbreaking discoveries.

What excites you about your current work? Are there any new topics or questions you hope to explore in the future?

The thrill of my current work is rooted in its complexity. Every day presents a new puzzle and introduces fresh challenges. However, the solutions to these challenges come from the consistent profiles we derive from the mass spectra. Analyzing molecules in a mass spectrometer is like listening to a choir, where each singer delivers their unique melody. Our exhilarating challenge is to identify these individual tunes and weave them into a comprehensive story. With mass spectrometry by our side, we

decode stories as intricate as the life journey of petroleum through organic geochemistry.

Similarly, when we tackle multifaceted environmental samples, it feels like we’ve got the ultimate key to deciphering nature’s most guarded secrets. Moving forward, I plan to deepen my research in the realm of complex mixtures, aiming to extract even more nuanced data. I’m on the brink of launching a new phase of investigation, focusing on the isotopic composition of the molecules routinely found in these mixtures. Isotopic data offer complementary layers of information, equipping us with the tools to chronicle the history of a given sample. This, in turn, holds the potential to address a myriad of questions spanning geosciences, environmental studies, and medicine. My ambition is to pioneer the development of nontraditional isotopic analysis methods, leveraging the capabilities of high-resolution mass spectrometry.

We understand that you serve as the general secretary for the Latin American Association of Organic Geochemistry (ALAGO). Can you tell us more about this role and the impact it has had on your career?

My journey with organic geochemistry began during my doctoral studies and has since been a driving force in my professional life. Over the years, this passion has yielded numerous rewarding outcomes, and my commitment to the field has only deepened—enter ALAGO, a nonprofit founded in 1988, dedicated to championing research in organic geochemistry. Since its inception, this association has been at the forefront of the field, hosting biennial meetings across Latin American cities. These gatherings create a vibrant space where academia and industry converge to discuss the latest in both methodological and conceptual advancements in organic geochemistry, as well as its interplay with other geoscience disciplines.

In particular, mass spectrometry stands tall in this domain. The field is constantly buzzing with fresh innovations tailored for applications in geosciences. Serving as ALAGO’s general secretary was a transformative chapter for me. It provided a platform to engage with brilliant minds from Brazil and across Latin America. Together, we exchanged knowledge, organized insightful seminars, and most recently, orchestrated our biennial congress in August 2023. Now, wearing the hat of ALAGO’s president, I’m on a mission: to elevate the association and position it as the premier

hub for fostering collaborations between academia and industry. Another great milestone in my career came last year when I was elected as an affiliate member for the Brazilian Academy of Sciences—I was very honored to receive this high recognition.

We understand that you work as an associate editor for a chemistry journal. Can you tell us more about this role and the impact it has had on your career?

Currently, I serve as an associate editor for *Química Nova*, which is a publication of the Brazilian Chemical Society. The journal predominantly features articles in Portuguese. This role marks my maiden voyage into the editorial world, and it has been nothing short of exhilarating. Diving deep into the editorial process has been incredibly enlightening. I've come to understand the intricacies of what goes on behind the scenes to ensure that only top-notch articles see the light of day. Undoubtedly, this role has enriched my career in more ways than one. It's not just about enhancing my skill set but also about expanding my network. Being at this editorial helm has fostered invaluable connections with a diverse group of chemists from all over Brazil.

What advice would you give to young scientists working in or entering the field of mass spec?

For young scientists venturing into the realm of mass spectrometry, here's my advice: Let passion be your guide. When you wholeheartedly commit and immerse yourself in your work,

success inevitably finds its way to you. First and foremost, ensure that this field truly resonates with your interests and aspirations. Once you've got that clarity, dive headfirst into the fascinating world of mass spectrometry. Like with all things science, patience is key. Stay consistent, persevere through the challenges, and I promise, the rewards will come your way.

What are some of your interests outside of the lab? Do they include any traveling, in addition to the traveling that you have done professionally?

Outside the lab, I cherish the simple joys of life. Traveling is a passion of mine, and while I've done my fair share of professional travel, nothing beats a weekend getaway with my family. I'm blessed with a wonderful wife and two beautiful children. We have a shared love for the outdoors, often escaping to the countryside or any spot where nature is in abundance. There's something about the natural world that captivates me; in fact, as I mentioned before, it was my observations of nature that first kindled my interest in science. Beyond that, I'm an early riser. Kicking off my day with a morning run invigorates me, setting the right tone and energy for whatever the day holds.



Boniek and his family during a holiday near Aracaju, Northeast – Brazil. Boniek on the left with Lucas in front of him, Edna to the right with Theo in front. (Photo courtesy of Boniek Gontijo Vaz.)