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INTERVIEW

Professor Orlando Fatibello Filho kindly granted an interview to BrJAC

Professor Fatibello holds a bachelor's degree in chemistry education from the Federal University of São Carlos (1976), a master's degree in Chemistry (Physical Chemistry) from the University of São Paulo (1980), and a PhD in Chemistry (Analytical Chemistry) from the Institute of Chemistry at the University of São Paulo (1985). He obtained his Habilitation (Livre Docência) in Analytical Chemistry from the Institute of Chemistry at the University of São Paulo in 2000. He completed a postdoctoral fellowship in the research group of George G. Guilbault at the Department of Chemistry, University of New Orleans, LA, USA (February 1987 to July 1989). He also served as a Visiting Full Professor in the Department of Chemistry at the Faculty of Sciences and Technology of the University of Coimbra, PT (March 2008 to February 2009).

Hired in December 1976 as an Assistant Professor, he has been a Full Professor at the Federal University of São Carlos since December 2003. He served as Director of the Analytical Chemistry Division of the Brazilian Chemical Society, was a member of the editorial board of the journal Química Nova, and has been a member of the editorial board of Analytical Letters since May 2005. He has been a Full Member of the Academy of Sciences of the State of São Paulo (ACIESP) since September 2012. In addition, he served as a member of the Chemistry Advisory Committee (CA) of the National Council for Scientific and Technological Development (CNPq) from July 2017 to July 2020.

He received second place in the Brazilian Association of University Presses (ABEU) Award with the book *Equilíbrio Iônico: Aplicações em Química Analítica* in the Natural and Mathematical Sciences category in November 2017. He was also a finalist for the Prêmio Jabuti in 2020 with the book *Potenciometria: Aspectos Teóricos e Práticos*. In 2025, he published the book *Problemas resolvidos do livro Equilíbrio Iônico: Aplicações em Química Analítica*.

He has published more than 378 scientific articles (h-index = 64), 9 book chapters, and 11 books. He has supervised 39 Master's students, 38 PhD students, and more than 90 undergraduate research students. In addition, he supervised 25 postdoctoral fellows. His former students are currently employed in several companies, the Brazilian Federal Police, and universities such as UFSCar, UNISANTOS, UEG, UFG, UFPR, UFBA, UFPA, UFPI, UFGD, UFMG, UFV, UEPG, UNESP, UEL, IFET Maranhão, UFRO, UNIP, and UNIOESTE, among others.

Professor Fatibello ranked 198th in the Ranking of Scientists in Brazilian Institutions according to the GSC Ranking Web of Universities, and is listed among the most influential Brazilian scientists worldwide in a study published in PLOS (10.1371/journal.pbio.3000918), as well as in the Brazil Top 10,000 Scientists – AD Scientific Index 2023 World Scientist and University Rankings.

He has extensive experience in Analytical Chemistry, with a strong focus on electroanalytical methods, bioanalytical chemistry, and optical analytical techniques in the UV-Vis region and chemiluminescence. His research encompasses flow injection analysis with electrochemical detection, UV-Vis spectrophotometry, turbidimetry, and chemiluminescence detection, as well as long optical path spectrophotometry.

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His work also includes the development of biosensors based on plant extracts and tissues; modified carbon paste electrodes; electrodes modified with polymeric films containing carbon nanotubes and/or metallic nanoparticles; and boron-doped diamond electrodes. In addition, he has contributed to Green Analytical Chemistry and chemistry education, particularly through the development of low-cost experimental approaches using everyday materials.

In recent years, his research group has focused on the synthesis and application of deep eutectic solvents (DES) for solid-liquid and liquid-liquid microextraction of analytes from food, environmental, biological, and pharmaceutical samples. Following extraction and preconcentration, analytes are determined using spectrophotometry, smartphone-based digital image colorimetry, or electroanalytical techniques.

His research addresses the limitations of conventional separation and preconcentration methods, which typically require large volumes of organic solvents, generate significant waste, and are time-consuming. In this context, DES have been explored as greener and more sustainable alternatives to toxic and volatile organic solvents, offering advantages such as low cost, ease of preparation, and high atom economy.

He has also contributed to the application of DES in the synthesis of metallic nanoparticles for electrochemical sensing. Notably, his group has synthesized ultrasmall platinum nanoparticles (USPtNPs) with diameters on the nanometer scale, which were used to modify glassy carbon electrodes for the determination of riboflavin.

Furthermore, a variety of ultrasmall metal nanoparticles (USMNPs), including Au, Ir, Pt, Ag, CeO_2, Cu, Ni, and iron oxides (Fe_3O_4 and Fe_2O_3), have been synthesized using DES as reaction media and subsequently applied in the fabrication of electrochemical sensors for the determination of analytes in diverse matrices.

BrJAC: What early influences encouraged you to study chemistry? Did you have any influencers, such as a teacher?

Prof. Fatibello: Several early influences pushed me toward chemistry. In 1966, I worked in a chemical industry, and it was there that I decided to study chemistry. Also, the curiosity about how things work—why metals rust, why baking makes cakes rise, and why some reactions release heat—also played an important role. Experiences such as school laboratory experiments or even home activities (*e.g.* mixing vinegar and baking soda, cooking, growing crystals) helped to spark this interest. Another strong influence was my teachers. A passionate science teacher can make a significant difference by demonstrating engaging experiments, connecting chemistry to real-world applications (such as environmental issues, medicine, pharmaceuticals, and materials), and encouraging curiosity and independent thinking.

Exposure to renowned scientists also contributed to my motivation. Learning about figures such as Marie Curie—whose laboratory I had the opportunity to visit in Paris—and reading books by Linus Pauling, known for his work on chemical bonding, reinforced my perception of chemistry as a meaningful and impactful field.

In many cases, a single memorable experience—such as observing a color change in a reaction or successfully carrying out an experiment—can become a turning point, transforming chemistry from an abstract subject into an exciting and engaging discipline.

BrJAC: How was the beginning of your career in chemistry?

Prof. Fatibello: My career in chemistry began in March 1977, when I joined the Department of Chemistry at the Federal University of São Carlos as a professor of chemistry. Both experimental and theoretical classes were an inspiration to me, leading me to pursue analytical chemistry.

BrJAC: What has changed in your profile, ambitions, and performance since the time you started your career?

Prof. Fatibello: When I started my career, my profile was defined mainly by curiosity and a strong willingness to learn. I was focused on building technical skills, understanding how organizations work, and proving my value through consistency and effort. At that stage, my ambitions were relatively short-term: gaining experience, developing competence, and finding my place professionally.

Over time, my profile has evolved to become more strategic and results-oriented. I've developed greater confidence in decision-making, improved my communication skills, and learned to collaborate more effectively across teams. I now approach challenges with a broader perspective, considering not only immediate tasks but also long-term impact and sustainability.

My ambitions have also grown. Instead of focusing only on personal development, I'm now motivated by contributing to larger goals, leading initiatives, and creating meaningful impact within my organization. I aim to continue growing into roles where I can influence direction, mentor others, and help drive innovation.

In terms of performance, the most significant change has been consistency and efficiency. I've learned to prioritize better, manage my time effectively, and deliver higher-quality results under pressure. I'm also more proactive, taking ownership of projects and seeking continuous improvement.

Overall, the journey has been one of growth—from learning and adapting to leading and contributing with purpose.

BrJAC: Could you comment briefly on the recent evolution of analytical chemistry, considering your contributions?

Prof. Fatibello: The recent evolution of analytical chemistry has been marked by significant advances in sensitivity, speed, and data analysis capabilities. Modern techniques now allow for the detection of compounds at trace levels, often in highly complex matrices, while also reducing analysis time and improving reliability. The integration of automation, miniaturization, and digital tools has further enhanced efficiency and reproducibility, making analytical processes more robust and accessible.

In my work, I have contributed to this evolution by focusing on method development and optimization, particularly in ensuring accuracy and consistency under challenging conditions. I have also applied analytical techniques to address practical problems, with an emphasis on data quality and the interpretation of results to support decision-making. In addition, I have worked to streamline workflows and adopt new technologies, including deep eutectic solvents (DES), where appropriate, aligning my efforts with the broader trend toward more efficient and sustainable analytical practices.

Overall, my contributions reflect a commitment to precision, innovation, and the continuous improvement of analytical methodologies in line with the field's ongoing transformation.

BrJAC: What are your lines of research? You have published many scientific papers — would you highlight any of them?

Prof. Fatibello: As mentioned, I have recently contributed to the application of deep eutectic solvents in analytical chemistry and several papers have been published in this field. Please take a look at my **Lattes CV**.

BrJAC: What is your opinion about the current progress of chemistry research in Brazil? What are the recent advances and challenges in scientific research in Brazil?

Prof. Fatibello: The current state of chemistry research in Brazil is strong, with many scientists conducting high-quality research across a wide range of fields, often in close alignment with international developments. Recent advances and challenges vary depending on the specific area of chemistry. Given the breadth of the topic, it is not possible to cover all aspects in this interview.

BrJAC: For you, what have been the most important recent achievements in analytical chemistry research? What are the landmarks?

Prof. Fatibello: Recent achievements in analytical chemistry have been shaped by a convergence of advances in instrumentation, data science, and miniaturization, allowing scientists to measure chemical

systems with unprecedented sensitivity, selectivity, and speed. One of the most important landmarks is the continued evolution of high-resolution mass spectrometry, particularly techniques such as Orbitrap mass spectrometry and time-of-flight mass spectrometry, which enable precise identification of complex mixtures in fields ranging from environmental analysis to proteomics. Coupled with chromatographic separation, these tools have made it possible to detect trace-level contaminants and biomolecules that were previously inaccessible.

Another major milestone is the rise of single-cell and spatially resolved analysis. Techniques like single-cell analysis and mass spectrometry imaging allow researchers to probe chemical heterogeneity within tissues, revealing biological processes at an extraordinary level of detail. These approaches are transforming biomedical research, especially in cancer diagnostics and precision medicine.

The integration of artificial intelligence and machine learning into analytical workflows is also a defining recent achievement. Algorithms are now routinely used for spectral interpretation, pattern recognition, and predictive modeling, significantly accelerating data analysis and improving reproducibility. This is particularly impactful in omics sciences, where datasets are large and complex.

Miniaturization and portability represent another landmark. The development of lab-on-a-chip systems and portable sensors has enabled real-time, on-site analysis in environmental monitoring, food safety, and clinical diagnostics. Technologies such as microfluidics have reduced sample and reagent consumption while increasing throughput.

Finally, advances in electrochemical and optical sensing have led to highly selective and sensitive detection platforms, including biosensors capable of detecting disease markers at very early stages. The rapid development of diagnostic tools during global health crises, particularly those based on CRISPR-based detection, highlights how analytical chemistry continues to play a central role in addressing urgent societal challenges.

Together, these achievements mark a shift toward faster, more precise, and more accessible analytical techniques, expanding the impact of analytical chemistry across science, medicine, and industry.

BrJAC: There are, in Brazil and in the world, several conferences on chemistry. To you, how important are these meetings to the chemistry scientific community? How do you see the development of national chemistry meetings in Brazil?

Prof. Fatibello: Scientific conferences play a central role in the chemistry community, both in Brazil and worldwide. They are not just venues for presenting results, but spaces where ideas are tested, collaborations are formed, and emerging trends are identified. In a field as dynamic as chemistry, the opportunity to exchange knowledge face-to-face accelerates scientific progress in ways that publications alone cannot achieve. Conferences also allow researchers—especially students and early-career scientists—to engage directly with leading experts, receive feedback, and build professional networks that often shape their future careers.

Another important aspect is the interdisciplinary nature of modern chemistry. Meetings bring together specialists from analytical, organic, inorganic, physical, and materials chemistry, as well as related areas such as biology, physics, and engineering. This interaction fosters innovation, as many of today's scientific challenges—such as sustainability, energy, and health—require integrated approaches. In this sense, conferences act as catalysts for new research directions.

In Brazil, national chemistry meetings have shown significant development over the years, both in size and scientific quality. Events organized by institutions such as the Brazilian Chemical Society have become increasingly important platforms for showcasing the country's scientific production. These meetings reflect the growth of Brazilian research, with a strong presence of graduate programs and increasing international participation. They also play a key role in reducing regional inequalities by providing opportunities for researchers from different parts of the country to present their work and establish collaborations.

Looking ahead, the continued development of national meetings in Brazil will likely depend on sustained investment in science and education, as well as efforts to increase internationalization. Hybrid formats, combining in-person and virtual participation, may further expand access and visibility. Overall, these conferences are essential for strengthening the scientific community, promoting innovation, and ensuring that Brazilian chemistry remains connected to global advances.

BrJAC: What is the importance of awards for the development of science and new technologies?
Prof. Fatibello: Awards play an important role in the development of science and new technologies by recognizing excellence, motivating researchers, and giving visibility to impactful work. At an individual level, receiving a prestigious prize—such as the Nobel Prize or the Fields Medal—can significantly enhance a scientist's career, opening doors to funding opportunities, collaborations, and leadership positions. This recognition not only rewards past achievements but also encourages continued innovation and risk-taking.

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Beyond individual recognition, awards help shape the direction of scientific research. By highlighting specific discoveries or fields, they signal what is considered important or promising within the scientific community. For example, prizes in areas like renewable energy, biotechnology, or artificial intelligence can stimulate further investment and attract new researchers to these fields, accelerating technological development.

Awards also contribute to public engagement with science. High-profile recognitions bring scientific achievements into the spotlight, making them more accessible to society and helping to build trust in scientific research. This visibility is crucial for fostering a culture that values science and supports policies aimed at research and innovation.

In addition, awards can strengthen institutions and national scientific systems. When researchers or groups are recognized, their universities and research centers gain prestige, which can translate into increased funding and international collaboration. In countries like Brazil, national awards and recognitions are particularly important for highlighting local talent and reinforcing the relevance of domestic research on the global stage.

However, it is also important to acknowledge that awards should strive to be inclusive and representative, ensuring that recognition reflects the diversity of contributions across different regions, genders, and career stages. When well-structured and fairly distributed, awards serve as powerful tools to inspire excellence, guide scientific priorities, and drive the advancement of science and technology.

BrJAC: For you, what is the importance of the national funding agencies for the scientific development of Brazil?
Prof. Fatibello: National funding agencies are fundamental to the scientific development of Brazil, as they provide the financial and institutional support that sustains research, innovation, and the training of human resources. Organizations such as CNPq, CAPES, and FAPESP play a central role in enabling research projects, scholarships, and international collaborations across all areas of knowledge.

These agencies are essential not only for funding equipment and infrastructure, but also for supporting students and early-career researchers through scholarships and fellowships. This investment is crucial for building a qualified scientific workforce and ensuring continuity in research activities. Without consistent funding, laboratories struggle to operate, long-term projects are interrupted, and the country risks losing talent to institutions abroad.

Another important aspect is that funding agencies help define national research priorities. By launching strategic calls and thematic programs, they can stimulate research in areas of high social and economic impact, such as public health, renewable energy, agriculture, and environmental sustainability. In this way, they act as drivers of innovation and contribute directly to technological development and competitiveness.

In addition, these agencies promote internationalization by supporting exchanges, joint projects, and participation in global scientific networks. This integration strengthens the visibility of Brazilian science and facilitates access to cutting-edge knowledge and technologies.

However, the effectiveness of these agencies depends on stable and adequate investment. Fluctuations in funding can compromise scientific progress and reduce the country's ability to respond to emerging challenges. Therefore, strengthening national funding agencies is not only a matter of supporting science, but also of ensuring Brazil's long-term development, sovereignty, and capacity for innovation.

BrJAC: What advice would you give to a young scientist who wants to pursue a career in chemistry?
Prof. Fatibello: Pursuing a career in chemistry can be both challenging and deeply rewarding, but it requires curiosity, persistence, and a willingness to continuously learn. One of the most important pieces of advice for a young scientist is to build a strong foundation in the core areas of chemistry while remaining open to interdisciplinary approaches. Modern chemistry increasingly overlaps with fields such as biology, physics, materials science, and data science, so developing a broad scientific perspective can be a major advantage.

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Equally important is gaining hands-on experience in the laboratory. Practical skills, problem-solving abilities, and familiarity with analytical techniques are essential for understanding how theory translates into real-world applications. At the same time, learning how to communicate science clearly—both in writing and in presentations—is crucial, as the impact of your work depends on how well it is shared with others.

Seeking mentorship and collaboration is another key step. Working with experienced researchers can provide guidance, open opportunities, and help you navigate challenges along the way. Participating in conferences, workshops, and research exchanges will also expand your network and expose you to new ideas and perspectives.

Resilience is fundamental in a scientific career. Experiments may fail, results may be unexpected, and progress can sometimes feel slow. However, these challenges are part of the process and often lead to the most meaningful discoveries. Staying motivated and maintaining a critical, yet optimistic mindset will help you move forward.

Finally, it is important to align your career with your interests and values. Chemistry offers opportunities in academia, industry, education, and entrepreneurship. Whether your goal is to advance fundamental knowledge or develop technologies that benefit society, maintaining a sense of purpose will make your journey more fulfilling and impactful.

BrJAC: For what would you like to be remembered?
Prof. Fatibello: If I were to answer that as a scientist, I would say I would like to be remembered not only for specific discoveries, but for the impact of my work on people and on the advancement of knowledge. Scientific results are important, but they are always part of a larger, collective effort. Contributing meaningful insights, helping to solve relevant problems, and advancing the field even in small steps are all part of a lasting legacy.

I would also hope to be remembered as someone who supported and inspired others—students, collaborators, and colleagues. Mentorship, generosity in sharing knowledge, and fostering a collaborative environment are just as important as publishing papers or receiving recognition. Science progresses through communities, not individuals alone.

Another aspect that matters is integrity. Being rigorous, honest, and responsible in conducting and communicating research is essential for building trust in science. A career marked by ethical commitment and respect for evidence leaves a more enduring contribution than any single achievement.

I would like to be remembered as someone who was curious, dedicated, and committed to making a positive difference through chemistry—whether by advancing scientific understanding, contributing to innovation, or helping others grow along the way.

Finally, my contribution to analytical chemistry has been strongly focused on teaching and on the development of educational resources that support the training of new scientists. Throughout my academic career, I have dedicated myself to helping students understand the fundamental principles of analytical chemistry and, more importantly, to connect theory with practical applications. I believe that a solid conceptual foundation is essential for students to confidently apply analytical methods in research, industry, and everyday problem-solving.

In addition to classroom teaching and laboratory supervision, I have also worked on producing didactic materials that make complex topics more accessible. This includes structured lecture content, laboratory guides, and problem-solving exercises designed to strengthen analytical thinking and experimental design skills. My goal has always been to encourage critical reasoning rather than memorization, helping students develop the ability to interpret data and evaluate analytical results independently.

A significant milestone in my academic journey has been the publication of a book in analytical chemistry. This work was developed with the intention of integrating theoretical concepts with practical examples, offering a comprehensive and updated perspective on the field. The book reflects both classical foundations and recent advances in analytical techniques, aiming to serve as a reference for undergraduate and graduate students as well as educators.

Through teaching and writing, I hope to contribute to the formation of well-prepared professionals who are capable of advancing the field of analytical chemistry. Education is one of the most lasting contributions a scientist can make, and I consider it a privilege to participate in the training of future generations of chemists.