doi:10.2533/chimia.2024.880 Chimia 78 (2024) 880

Flow Chemistry Highlights

Flow Chemistry Network

An Interview with Prof. Andrew J. deMello

For this Flow Chemistry Column, we are happy to interview Dr. Andrew J. deMello, professor of Biochemical Engineering, ETH Zurich.

Flow Chemistry Network:
What brought you to the field of flow chemistry, and what made you stay and contribute in the area?

Andrew J. deMello:
We started using microfluidic systems for chemistry and biology over 25 years ago. Initially we spent our time developing flow-based reactors for small molecule chemistry and DNA amplification and showed that both reaction efficiency and throughput could be dramatically improved, but our interest then turned to nanomaterial synthesis. We have spent a lot of time creating intelligent platforms for producing materials like quantum dots and perovskites. This activity is still close to my heart, and I think showcases how powerful flow-based technologies can be, especially with respect to throughput and reaction control.

Flow Chemistry Network:
In your opinion, what have been the major developments in the field over the years?

Andrew J. deMello:
In the early days, we focused on showcasing the utility of 'flow' in synthetic applications. It was easy to show the effectiveness of flow-based formats in biology, such as PCR, which quickly became commercialized and widely adopted.

Demonstrating impact in small molecule chemistry was and remains a significantly more challenging endeavor. While improving reaction yields is straightforward, executing complex, multi-step workflows in a continuous, automated way is tremendously difficult due to the need for work-up, purification, and quality assurance. Fortunately, recent technological advances make it likely that more complex chemistries will soon move to flow-based platforms.

Flow Chemistry Network:
What are the exciting innovations in the field today which you think could have an even greater impact?

Andrew J. deMello:
I think that this year's Nobel prizes in Chemistry and Physics highlight the growing impact of AI and machine learning in the chemical and biological sciences, which will only accelerate. Flow based reactors, especially microfluidic variants, are fantastic at generating extremely quickly chemical and biological information of exceptional quality. Machine learning algorithms need as much good quality data as they can get, so to me this appears to be a marriage made in heaven. I'm excited to see how innovations in both areas will impact the discovery of new molecules and materials in the coming years.

Flow Chemistry Network:
What should a young researcher/industrial chemist keep in mind when embarking on using flow processing?

Andrew J. deMello:
That's a tough question. Innovation in science and technology is driven by creativity, so young researchers should carefully consider where to apply flow processing. While it's easy to make small improvements, the most impactful innovations transform how problems are approached. My advice: "Think big and don't be afraid to tackle challenges others have avoided."

Flow Chemistry Network:
Flow chemistry is already considered as a mature technology. What is left to do to make this a standard tool for chemists and chemical engineers?

Andrew J. deMello:
Flow chemistry has advanced significantly over the past three decades, demonstrating clear benefits over batch formats. That said, we're a long way from creating robust platforms that can perform a range of complex chemistries in an automated fashion. To ensure that chemists and chemical engineers 'think flow' as a matter of course, we need user-friendly, flexible platforms that can be applied to the right synthetic systems. We're getting there, but there is still much to do…

Received: October 14, 2024

Would you like to propose a Flow Chemistry Highlight topic here?
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