



## Flow Chemistry Highlights

### Flow Chemistry Network

Selected Topic: An Interview with David Linder from Roche

For this Flow Chemistry Column, we are happy to interview **Dr. David Linder**, a plant Chemist working at F. Hoffmann-La Roche AG in Basel in the Department of Drug Substance Scale-up and Supply



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

**David:** I started my industrial career at BASF in Ludwigshafen (DE) in the process development department for basic chemicals. Being freshly out of a post-doc in total synthesis, I was suddenly confront-

ed with the fact that most of the chemical processes were run in a continuous manner on large scale. Interestingly, the chemical reactions were still mostly performed batchwise in the lab. This forced us to constantly translate the experimental results obtained batchwise into insights for running the next larger scale in a continuous manner. 'Conti' has remained a beloved hobby ever since.

**Flow Chemistry Network:** To your mind, what have been the major developments in the field over those years?

**David:** I would say that rethinking our processes as flow have unlocked some previously impracticable chemical reactions, like liquid-phase photochemistry for instance. However, the major development is that the range of 'unsafe' chemical reactions is being drastically reduced, opening up much more direct routes to our target molecules. Exactly there lies the biggest benefit of flow itself and of all its combinations with discontinuous processing methodologies.

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

**David:** The biggest advantage of flow is the speed at which the effect of an input variation can be measured. Provided the system is equipped with a suitably fast responding and sensitive sensor, there is no more need to tediously isolate large quantities of product to know the effect. Nevertheless, we are still very dependent, also in flow, on characterizing our systems at various 'states of control' hence neglecting the huge amount of data generated during transitions from one stable state to the next. With the assistance of AI we will probably soon be able to harvest the insights also from the dynamic data and characterize design spaces with an unprecedented level of detail.

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

**David:** A long time ago (when I was a student), one could choose between chemistry and chemical engineering. The first being shifting electrons between molecules and the second moving calories and mass around in an industrial equipment. My advice to a chemist would thus be to make everything possible to understand the world of engineering. Neither a chemist nor an engineer will be able to set up a good flow process without the other's precious contribution. After all, the chemical transformations are only a fraction of a process, which requires many additional physical manipulations before delivering a product.

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

**David:** I would argue that flow chemistry is not a technology but rather a philosophy. Take a continuous stirred-tank reactor (CSTR) cascade, for instance, there is not much difference between a CSTR and a batch reactor; except the way they are being used. There is a certain technological maturity in the field now, but I think, particularly in the pharma industry, we are still struggling to adapt our mindset accordingly.

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

Please contact Agnieszka Ladosz or Christophe Allemann, E-mail: [agnieszka.ladosz@idorsia.com](mailto:agnieszka.ladosz@idorsia.com); [christophe.allemann@hefr.ch](mailto:christophe.allemann@hefr.ch)