Young Career Focus: Dr. Max von Delius (Friedrich-Alexander University Erlangen-Nuremberg, FAU, Germany)

Background and Purpose. From time to time SYNFORM meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Dr. Max von Delius (FAU Erlangen-Nuremberg, Germany).

Biographical Sketch

Dr. M. von Delius

Max von Delius was born and raised in Nuremberg (Germany). He studied chemistry at FAU in Erlangen (Germany) and at Université Louis Pasteur in Strasbourg (France). In 2007, he moved to Edinburgh (Scotland, UK) where he worked towards his PhD in the lab of Professor David A. Leigh. His doctoral work focused on artificial molecular machines with a special emphasis on 'walking molecules'. From 2011 to 2012 he was a Leopoldina postdoctoral fellow in the group of Professor Vy M. Dong at the University of Toronto (Canada). During his postdoc, he worked on several projects in the area of homogeneous catalysis, including Ni-catalyzed CO_2 fixation and Rh-catalyzed hydroacylation of olefins. Since 2013, he has been a junior research group leader at FAU Erlangen-Nuremberg. His group is interested in the behavior of complex chemical systems based on interacting organic molecules (systems chemistry), as well as in the synthesis of functional materials, for example, for organic solar cells. He has received numerous awards and fellowships, including most recently a generous funding package provided by the Emmy-Noether Program of the DFG.

INTERVIEW

SYNFORM *What is the focus of your current research activity?*

Dr. M. von Delius The research in my group can be summarized under the heading 'organic systems and materials'. The first part of this group motto relates to a trend that has been picking up speed rapidly over the past five years: (organic) chemistry is no longer limited to the synthesis of pure molecules and their uses. Thanks to advanced analytical tools such as HPLC-MS, more and more groups are becoming interested in complex dynamic mixtures and the unexpected behavior that can often be observed in such systems. While this area of research, often called 'systems chemistry', is mainly curiosity-driven, the second area of research, functional materials, usually comes with a specific application in mind. For example, we are currently engaged in a fruitful collaboration on new materials for organic solar cells, but we are also actively pursuing promising avenues in other areas.

SYNFORM *When did you get interested in synthesis?*

Dr. M. von Delius My interest in organic synthesis really took off in the fourth year of my undergraduate studies, while I was doing research in the lab of Nobel laureate Jean-Marie Lehn in Strasbourg. During those five months, I was allowed to work independently on a rather complex ligand synthesis and I realized how profoundly satisfying it can be to synthesize and characterize compounds that no one else has made (or ever smelled!) before. Even better, once the synthesis was accomplished, I could set out to use these compounds to achieve certain (supramolecular) functions.

SYNFORM *What do you think about the modern role and prospects of organic synthesis?*

Dr. M. von Delius During my postdoc with Vy Dong, working on frontier research in catalysis, I realized what an abundance of synthetic problems is still out there waiting to be solved. For people like me who have a background in supramolecular chemistry or organic materials, it can sometimes seem as if organic synthesis is essentially a solved problem. But this is far from true for anything that goes beyond 'clicking' building blocks A and B together. I have the impression that vast areas of chemical space are still completely unexplored and that there is still a lot of 'gold' to be found for groups that are willing to engage in ambitious research programs. At the same time, I believe that while we should, wherever possible, look out for potential applications for our methods and materials, we should never narrow our focus too much on applied science. The great risk of such a narrow focus is that sooner or later the very start of the chemical research pipeline would run dry and the consequences of this would be felt by everyone further down the value chain.

SYNFORM *Your research group is active in the areas of organic synthesis and materials science. Could you tell us more about your research and its aims?*

Dr. M. von Delius We have already contributed a new chemical tool (orthoester exchange) to the area of systems chemistry, which we are currently applying toward generating various types of interesting dynamic systems. Some major challenges in this area include the design of dissipative systems that consume fuel and operate far from equilibrium and the development of systems and materials in which the sum of the mixture has properties superior to those of the individual components (e.g. in molecular sensing). In the area of functional materials, we were able to prepare solar cells that, thanks to our new azafullerene $DPC_{59}N$, could beat the benchmark fullerene PCBM in certain performance parameters. One of our current goals is to prepare second-generation compounds, which we expect will allow further performance enhancements.

SYNFORM *What is your most important scientific achievement to date and why?*

Dr. M. von Delius Just a few weeks ago, we published a paper in Nature Communications [DOI: 10.1038/ncomms8129], in which we describe the first one-pot synthesis of a monometallic cryptate (a small organic cage compound that accommodates a metal ion; see Figure). This finding is very exciting to us, because for the first time in 50 years of research on these smallest cage compounds, it is now possible to make them under thermodynamic control, which also opens up the possibility of subcomponent self-sorting, i.e. allowing metals to select their preferred host. The compounds we have prepared during this project are also the first cryptates that have a 'self-destruct button', which could be a useful property for applications in drug delivery.