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# Conference Report

## The 48th EUCHEMS Conference on Stereochemistry
## Bürgenstock Conference 2013

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This year's EUCHEMS Conference on Stereochemistry – the '48th Bürgenstock Conference' – was once again held at the picturesque Seehotel Waldstätterhof at the beautiful shore of Lake Luzern in Brunnen (from April 28th to May 3rd 2013). The stunning setting was complemented with an outstanding scientific program that was revealed only upon arrival of the participants on Sunday afternoon and was carefully put together by the organizing committee, ***Alain De Mesmaeker*** (Syngenta), ***Jérôme Lacour*** (Uni Geneva), ***Reto Naef*** (Novartis), ***Philippe Renaud*** (Uni Bern), ***Helma Wennemers*** (ETH Zürich) and this year's president, ***Luisa De Cola*** (Strasbourg/KIT).


Luisa De Cola and Helma Wennemers

Luisa De Cola welcomed all participants at the opening dinner on Sunday evening, and introduced this year's guest of honour, ***David Reinhoudt*** from Twente University, with warm remarks from the balcony of the dining hall.

The scientific program kicked off with a big bang after dinner – literally, as Katharina Fromm (Fribourg) introduced the first speaker ***Michael Grätzel*** (EPFL) with live experiments. Prof. Grätzel delivered a spectacular lecture on molecular photovoltaics and artificial photosynthesis. Introducing first the concept of dye-sensitized solar cells with an emphasis on chemical aspects, he then reviewed the developments since the first prototype cell in 1988 and discussed the challenges for developments of more efficient systems. The key to high collection efficiency is to realize an about 100-fold faster electron transport than charge recombination within the cell. With porphyrin-based dyes along with Co-based redox electrolytes and perovskite light harvesters, as high as 15% efficiency of the dye sensitized cell could be realized. For future developments, Prof. Grätzel emphasized the value of computational tools, and closed the lecture with examples of remarkable real-life applications of dye-sensitized solar cells around the globe.


Michael Grätzel

The Monday morning session was moderated by Marco d'Ischia and focussed on materials and their applications. ***Jeff Hubbell*** from EPFL lectured first and gave a thrilling talk on the engineering of materials and proteins for the modulation of cellular responses with a particular emphasis on synthetic materials and applications to tissue growth and repair. This was exemplified in the repair of diabetic wound infections. Prof. Hubbell additionally stunned the audience with a second account that was concerned with the modulation of tumor cell behaviour, more precisely research towards a nanoparticle-based cancer vaccination, targeting dendritic cells in tumor draining lymph nodes.


Jeff Hubbell

This lecture was followed by a lively discussion and subsequently Jeff Hubbell's former postdoctoral fellow, ***Heather Maynard*** (UCLA) took the stage. Professor Maynard lectured on her polymer research and applications thereof for drug delivery. Where proteins as drugs may have several drawbacks due to their instabilities, such as challenges in transport and storage, the protein–polymer conjugates developed in the Maynard group show much longer life-times and therefore offer tremendous potential for pharmaceutical applications. Prof. Maynard skilfully led the audience through the various site-specific synthetic methods that her group developed to prepare and purify the desired polymers and showcased the synthesis and application of disaccharide-based biopolymers (*i.e.* a trehalose polymer) for protein stabilization. Such biopolymers also show potential for wound healing.


Heather Maynard and Katharina Fromm

The later Monday afternoon was dedicated to the first poster session of the meeting that displayed 21 posters of emerging scientists. Five junior group leaders were additionally selected to present their research in eight-minute oral presentations as appetizers for the poster session. Contributors included ***Beat Fierz*** (EPFL), ***Matthew Fuchter*** (Imperial College), ***Franziska Schoenebeck*** (ETH Zürich), ***Jan Streuff*** (Freiburg University) and ***Mariola Tortosa*** (University of Madrid). This was followed by a very lively two-hour poster session.

The evening lecture featured ***Dennis Curran*** (Pittsburgh University) who outlined the usefulness of fluorine tags to distinguish and separate enantiomers. Prof. Curran has previously been recognized for this work with an ACS Fluorine award – without ever having formed a carbon–fluorine bond, as he proudly noted. In his lecture, Professor Curran impressively showcased how the technique can be utilized to analyze complex natural product stereoisomer libraries obtained by split and mix synthesis and thoroughly presented the challenges and difficulties in the correct reproduction and characterization of natural product isomers relating to temperature, concentration or solvent of the NMR sample.


Dennis Curran


Michael Krische and David Reinhoudt

Under the moderation of Andreas Pfaltz (Basel University) Tuesday's programme started with a lecture by ***Michael Krische*** (University of Texas at Austin) who outlined a variety of highly impressive and elegant transformations in relation to metal mediated catalytic hydrogenation and transfer hydrogenation reactions for the construction of carbon–carbon bonds. In particular novel Rh- and Ir-catalyzed enantioselective transformations were disclosed such as the application of butadiene as a crotyl donor in transfer hydrogenative C–C bond formation or the development of redox triggered cycloadditions of 1,2 diols. These methods were then elegantly employed in the context of complex polyketide natural product synthesis such as erythronolide B.


Veronique Gouverneur

The programme continued equally impressively after a short coffee break, featuring ***Veronique Gouverneur*** (University of Oxford) as the second speaker of the morning session. After introducing the relevance and background of PET imaging, Prof. Gouverneur described a number of remarkable and novel synthetic methods to introduce fluorine into molecules for such imaging applications, with particular emphasis on sp$^3$ C–F bonds. The numerous challenges for synthetic chemists for reaction development were discussed in a very stimulating and enthusiastic manner. Given the short half-life of $^{18}$F, protocols require compatibility with heat, functional groups and rapid reaction times. Prof. Gouverneur's group has succeeded in overcoming many of the latter, and C–F bond formation protocols involving metal (Pd, Ir, Cu) or photoredox radical-based protocols were presented. As for all scientific lectures, a very active and elaborate question session followed.

Tuesday evening was dedicated to music and following the conference dinner, the participants got together to enjoy the vocals of Pilar – an award-winning Italian singer who performed, supported by a bassist and guitarist, a number of beautiful chansons. Her unique style and performance amazed the conference delegates, and thanks to Luisa De Cola's choice (and recommendation by her niece), will fondly be remembered by everyone.


Christoph Weder

Wednesday morning's session started with an impressive presentation given by ***Christoph Weder*** (University of Fribourg) on stimuli-responsive polymers based on noncovalent interactions. This lecture touched on many different aspects of smart materials such as mechanically adaptive nanocomposites, healable polymers and the mechanochemistry behind these phenomena. Inspiration from nature, *e.g.* the stiffening of the skin of sea cucumbers, was translated into the development of adaptive electrodes used for cortical interfacing. Stunning applications of metallosupramolecules as adaptive polymers rounded up this inspiring presentation followed by an in-depth discussion.


Gianluca M. Farinola

Moderator Per-Ola Norrby then introduced the next speaker of the Wednesday morning session, ***Gianluca M. Farinola*** (Università di Bari), who started his lecture with an overview of their latest research dealing with enantioselective solid-state sensors. Switching gears, he then presented how one can reconstitute the plant photosystem by conjugation of light harvesting artificial antennas to the reaction center of the photosystem and how this can be used to generate charge separated states. In another nature-inspired part of his talk he pointed out the beauty and wealth of biosynthesized nanostructured silica from diatoms and how one can make use of these materials that nature so readily provides, *e.g.* as growth-promoting scaffolds for osteoblast-like cells.


Huw Davies

Wednesday evening's speaker ***Huw Davies*** (Emory University) was introduced by E. Peter Kündig and crowned on the stage (with a tailor-made dragon-shaped welsh balloon crown) by Robert Eagling before his presentation began. He introduced the new NSF center for C–H functionalization in which many different working groups across the US are organized to bring C–H functionalization into the main stream of organic synthesis. This was followed by a comprehensive overview of stereoselective reactions of rhodium carbenes and how these can be used in C–H functionalizations as a paradigm-shifting synthetic strategy. Special emphasis was put on the substitution pattern adjacent to the carbenes and how this can affect high-turnover catalysis. This was vividly corroborated with a movie showcasing the velocity of $N_2$ release from a precursor upon catalyst addition. The lecture culminated in the proposal of a novel coordination model for carbenes in iridium pincer-ligand catalysts and a novel prediction model for the stereoselectivity in these syntheses that stirred an intense discussion afterwards.


Nicolas Winssinger

The chemical biology session of Thursday morning was moderated by Christian Bochet and opened by ***Nicolas Winssinger*** (University of Geneva) who gave a formidable presentation on peptide nucleic acids (PNA) and how one can perform encoded synthesis with PNA tags leading to versatile bar-coded libraries. He outlined the utilities of these libraries in fragment-based drug discovery, exemplifying their efforts with the targeting of DC-SIGN, a protein highly important in HIV pathology. As another example, a fragment-based screening was refined to a focused library for MEK, an important kinase in the prominent mitogen-activated (MAP) kinase pathway. Another stunning example for an application of PNA was introduced with PNA-templated reactions in which the reaction partners are assembled in close proximity on a template strand. This led to impressive rate enhancements in the studied reactions and was further elaborated to *in vivo* imaging of RNA sequences and proteins based on immolative linkers.


Tom Muir

In the next session, ***Tom Muir*** from the University of Princeton gave a breathtaking talk on how one can assemble in the laboratory dauntingly large structures such as nucleosomes by combining chemistry and biology and eventually elaborate them into chromatin. He made the point that this is going to be of tremendous importance to understand the function of post-translational protein modifications (PTMs), especially in the context of epigenetics and their role in human pathologies such as cancer. He underscored this by an example recently studied in their laboratories, where a single lysine to methionine mutation in only 1% of total histone led to diminished overall methylation levels causing pediatric glioblastoma. He then continued to showcase the utilities of designer chromatin to study functional and mechanistic aspects of heterochromatin misspreading. His presentation was topped-off with studies of how one can accelerate biochemical assays with DNA barcoded chromatin libraries for parallel biochemistry elegantly linking this part of the talk with the lecture given before.

The two morning lectures were followed by five additional eight-minute short talks as an introduction to the second poster session. The selected speakers were ***Gonçalo Bernardes*** (University of Cambridge, UK), ***Micha Fridman*** (Tel-Aviv University), ***Seiji Shirakawa*** (Kyoto University), ***Boris Vauzeilles*** (CNRS, Gif-sur-Yvette) and ***Sandeep Verma*** (IIT Kanpur). These presentations served as appetizers for another two hours of intense discussions at the posters.

Thursday evening's lecture was given by ***Viola Vogel*** (ETH Zürich) who was introduced by Donald Hilvert (ETH Zürich). She impressed the audience with her presentation on the art of how to make and break a bond, especially related to the influence of mechanical forces in these processes. The importance of mechanical forces was highlighted in functional regulation by stretching of proteins and the application of mechanical forces exerted by cells on their substrates. Moreover, mechanochemical aspects are important to wound healing and infection. The question of how bacteria adhere to surfaces leading to the stunning concept of catch-bonds was another revealing facet of this talk and may lead to new types of antibiotics. The talk was rounded-up by some inspiring thoughts on extracellular phosphorylation. As the audience was confronted with a novel perspective on the art of how to make and break a bond, a lively discussion followed this thoughtful presentation.


Viola Vogel

On Friday morning, Antonio M. Echavarren introduced the next speaker, ***Jun-Ichi Yoshida*** (Kyoto University), who presented his recent advances in flash chemistry. He detailed to the audience why some reactions cannot be done in batch and related this to the time-scales that are needed to get some reactions to work in a flask. He further elaborated how the reaction time can be related to reaction space in flow chemistry systems and how this can be exploited to precisely control transformations in the millisecond realm. He then presented some recent examples where they were able to intercept very short-lived intermediates like carbocations, glycosyl cations and organolithium species in transformations that would not be possible in batch. One of the most impressive transformations he disclosed was surely the asymmetric carbolithiation using configurationally unstable reactive carbanions on the millisecond scale. These processes can be upscaled from laboratory-scale to industrial pilot plant production, giving a truly spectacular example of applications of flash chemistry.


Jun-Ichi Yoshida

The last lecture of this outstanding Bürgenstock Conference 2013 was held by ***Bruno Chaudret*** (CNRS-INSA, Toulouse) who highlighted his research on organometallic nanoparticles and the question of what one can do with them. His talk went along the faces, edges and corners of organometallic nanoparticles and the distinct strategies of how to modify these positions selectively. He then touched on the field of bimetallic RuPt nanoparticles and how one can efficiently synthesize these particles with control over size and shape. He ventured further into the analytical aspects of his research, how one can study and assign surface species and then disclosed a spectacular application of his nanoparticles in organic chemistry: the stereospecific H/D exchange in nitrogen containing molecules such as amino acids. From the organic applications of the nanoparticles he then went to a physical application of iron nanoparticles: controlled magnetic heating.


Bruno Chaudret

We will remember the 48th Bürgenstock conference as an outstanding scientific event that was thoughtfully organized by the committee and its president Luisa De Cola. The breadth of the scientific program presented by distinguished international experts in a wonderful atmosphere sets the bar very high for next year's Bürgenstock.

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