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Chemistry

Platform of the Swiss Academy of Sciences

The 8th Young Faculty Meeting – An Active Crowd Attuned to Modern Challenges

Yoan C. Simon^{*a}, Henning J. Jessen^{*b}, and Leo Merz^{*c}

^{*}Correspondence: Dr. Y. C. Simon^a, Prof. Dr. H. J. Jessen^b, Dr. L. Merz^c

^aAdolphe Merkle Institute, Université de Fribourg, Chemin des Verdiers 4, 1700 Fribourg, E-mail: yoan.simon@unifr.ch; ^bUniversity of Zurich, Department of Chemistry, Winterthurerstrasse 190, 8057 Zurich, E-mail: henningjacob.jessen@uzh.ch; ^cSwiss Academy of Sciences (SCNAT), Platform Chemistry, Laupenstrasse 7, 3008 Bern, E-mail: chemistry@scnat.ch

About 25 young academic researchers in chemistry met on June 3rd 2015 in Bern for the Young Faculty Meeting (YFM) to share their thoughts, experiences and interests about life in Swiss chemistry labs as future leaders in academia. Already in its eighth year, the YFM, which is co-organized by the «Platform Chemistry» of the Swiss Academy of Sciences (SCNAT) and two young chemists, gathers every year piecemeal Ambizione Fellows, Maîtres Assistants, Habilitands, SNF Professors and other young laboratory heads in a spirit of exchange and comradeship. This year's YFM was jointly organized by **Yoan C. Simon** (Adolphe Merkle Institute, Freiburg), **Henning J. Jessen** (University of Zürich) and **Leo Merz** (SCNAT) and generously supported by the member companies of KGF (Kontaktgruppe für Forschungsfragen): BASF, F. Hoffmann-La Roche, Novartis and Syngenta.

Following the proven standard format, the morning session was devoted to science. Six young faculty members from diverse horizons and working on multifarious areas of chemistry presented the fruit of their research. An impressive breadth and depth of knowledge was displayed through and through and the vibrancy of the field of chemistry across the Swiss academic landscape was expressed.

The session was kicked off by **Lucas Montero de Espinosa** (Adolphe Merkle Institute, University of Fribourg) with his talk about 'Supramolecular polymers based on the isophthalic acid-pyridine H-bond: Low complexity, high performance'. He revealed how simple yet powerful non-covalent binding motifs



Michal Juriček

(such as H-bonding) can be directed to impart one-of-a-kind properties to polymeric materials. The power of this strategy lies in the combination of otherwise simple building blocks (e.g. isophthalic acid and pyridine) in a savvy architecture that permits to achieve ease of processing and stimuli-responsiveness. Capitalizing on the dynamic nature of supramolecular motifs, the materials can readily be tuned to fabricate adhesives, coatings and/or self-standing materials with adjustable stiffness and light-healability.

In his talk 'Diradical and diradicaloid polycyclic hydrocarbons' **Michal Juriček** (Department of Chemistry, University of Basel) dove into the intriguing world of diradical and diradicaloid polycyclic hydrocarbons. Beyond the noteworthy intricacies behind the multi-step synthesis of such polyaromatic compounds, most striking were the unique electronic properties resulting from their molecular architectures. For instance, HOMO-LUMO gaps were found to be 10 times lower than benzene and the singlet and triplet excited levels possess unusual relative positions. Starting from racemic binol, the chiroptical and magnetic properties of these twisted systems were addressed. In addition, Michal exposed some of the strategies (e.g. fluorination) to circumvent the intramolecular ring-closure and planarization incurred by these twisted (M)- and (P)-helices.



Madhavi Krishnan



Sereina Riniker and Henning Jessen

Moving from experimental to computational chemistry, **Sereina Riniker** (Department of Chemistry and Applied Biosciences, ETH Zürich) explained in her talk ‘Synergies between molecular dynamics and cheminformatics’ the differences between molecular dynamics (MD) and cheminformatics (CI) and how these two methodologies could be synergistically combined to make powerful predictions. Taking advantage of the atomistic force field, MD can use a ‘leap frog’ algorithm to look at molecular motions in time in 3D. Despite the ability to predict longer timeframes, some limitations are still present such as sampling issues, coarse-graining and the accuracy of the force field. In contrast, CI is mostly a 2D static method used for instance in screening and that would benefit from an improvement of some of the descriptors. Eventually, through the combination of MD and CI and the appearance of more and more open databases, *in silico* drug design will become more accurate and reliable.

Exposing the evidence of the high carbon-dependency of modern society, **Jeremy Luterbacher** (Laboratory for Sustainable and Catalytic Processing, EPF Lausanne) pledged for the utilization of lignocellulosic materials as a sustainable source of carbon in his talk titled ‘Chemical conversion of biomass to sugars and lignin monomers using green solvents’. Some of the limitations of current biomass strategies reside in the omission of lignin byproducts due to the difficulty to valorize them. To address this, γ -valerolactone (GVL) was utilized to attain complete dissolution of lignocellulosic materials under mild conditions with acids of sufficient strength. A significant rate-enhancement effect was observed in GVL, consistently with



Jeremy Luterbacher



Plinio Maroni

a reduction in activation energy. The industrial viability of the process was also broached and it was shown how the process is compatible with biological upgrading reaching remarkable yields with unevolved yeast strain.

Going from large-scale to nanoscale, **Madhavi Krishnan** (Department of Chemistry, University of Zürich) presented her views and work on the control matter at the 1 to 100-nm scale in a talk titled ‘How to trap your nano-object: pushing the boundaries on spatial control of matter at the nanometer scale’. A historical perspective of the manipulation of mesoscopic matter was introduced to emphasize the challenges associated with the control of ‘small and warm’ systems. She then explained her research based on thermodynamic traps using electrostatic forces operating on surfaces. The applicability of these potential wells to trap and manipulate gold nanoparticles and nanorods as well as proteins was broached. Such wells can be used to quantify charge but also to generate bits by fabricating special T-shaped wells for non-volatile electrically writable optical memory and data storage.

The following talk ‘Investigating polyelectrolyte adsorbed on surfaces with AFM, quartz crystal microbalance and reflectometry’ continued along the line of soft-matter manipulation, **Plinio Maroni** (Laboratory of Colloid and Surface Chemistry, University of Geneva) delved into the realm of charged polymer interfaces and demonstrated the importance of understanding these concepts for applications ranging from the paper making industry to all sort of slurries to surface modifications of materials. He then went on to explain how reflectometry and quartz crystal microbalance work can be allied to get some powerful information about the



Scientific discussions continued through the lunch break.

dry and wet masses of polymers and their swelling behavior. Furthermore, it was demonstrated how single-molecule force spectroscopy could be used to manipulate complex objects such as dendronized polymers to underline the specific necklace structure of higher generations dendronized polymers.

Throughout the day, the attendees had ample time to share their experiences and to network. The afternoon session was geared towards some of the tasks that academics are asked to perform without any sort of formal training.

This session was started by **Patrick Jermann** (Center for Digital Education, EPF Lausanne) with ‘MOOCs, a million participants later. What have we learned?’. He discussed an ongoing worldwide revolution in university teaching: massive online open courses, a.k.a. MOOCs. Building upon the rich expertise and pioneering endeavors of EPFL in this field in Switzerland, he highlighted the scope of MOOCs and the challenges in their implementation. From technical aspect (*e.g.* how to set up a MOOC studio without a professional studio) to more noble enterprises (*e.g.* bringing education to the developing world), the potential of MOOCs was debated and the interest in this subject was manifest through the multiple questions of the audience spanning from the future of traditional curricula to the controversy associated with the deliverance of degrees.



Pia Viviani



Patrick Jermann

As young faculty members, the race to numerous high-quality publication is typically a given; the maxim ‘publish or perish’ is now solidly anchored in academia. Yet, **Wolfgang Henggeler** (Unitectra, Basel, Bern and Zürich) plausibly explained to the audience that one may want to refrain from sharing too quickly in his instructive talk ‘Technology transfer from academia: The role of intellectual property protection’ and first to reflect upon the patentability of the latest findings. To help identify the requirements, he highlighted some of the guiding principles of intellectual properties, and reviewed the three criteria of



Wolfgang Henggeler

patentability: novelty, usefulness, inventiveness. Additionally, diverse scenarios were explained depending on the maturity of a technology such as the possibilities to license a technology or to start a spin-off company. He then went on to highlight some of the successes of Unitectra in bringing ideas to market.

Finally, **Pia Viviani** (Science-et-Cité, Bern) introduced her views on science communication in ‘How to do science communication’. The diverse aspects of science communications were delineated: how to interact with journalists and the public and which different approaches are currently en-vogue. Pia encouraged the participants to take part in the public outreach activities offered by the Swiss Universities and highlighted the possibilities currently supported by Science-et-Cité, such as Science Cafés and Workshops that provide a fantastic opportunity to transport research topics into public perception.

The afternoon session was a real success as it spurred on numerous questions and excitement that extended beyond the presentations and into the aperitif that followed.

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Additional information about the «Platform Chemistry» and its activities may be found at chemistry.scnat.ch.

