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Conference Report

Euroanalysis 2023 in Geneva

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Between the 27th and 31st of August 2023 Geneva became a focal point of analytical sciences by hosting Euroanalysis XXI (https://www.euroanalysis2023.ch). This biannual conference is the most important event of the Division of Analytical Chemistry of the European Chemical Society and is traditionally organized by the analytical division of the chemical society of the host country. Accordingly, the Division of Analytical Sciences of the Swiss Chemical Society (DAS-SCS) together with the University of Geneva were given the task to organize the 2023 conference, which was the 21st in the Euroanalysis series. Eric Bakker (University of Geneva and DAS President), Bodo Hattendorf (ETH Zurich and DAS executive committee), Franka Kalman (HES-SO Valais-Wallis and EuChemS DAC representative of the DAS and member of the EuChemS DAC steering commitee) and Marc Suter (Eawag and former DAS President) were the organizers (Fig. 1), strongly assisted by Bertrand Joehr and Angelica Vigo from Symporg SA.

Fig. 1. From left to right: The conference chairs Marc Suter (Eawag), Bodo Hattendorf (ETH Zurich), Eric Bakker (University of Geneva) and Franka Kalman (HES-SO Valais/Wallis). © Eric Bakker.

The meeting attracted in the order of 500 attendees from academia, research institutes, regulatory organisations and industry. The conference theme was 'Analytical Probing of Complex Systems', and as such placed a strong emphasis on the development and application of analytical approaches for solving real-world problems ranging from bioanalytical, biomedical, global health and food analytics to the environmental sciences, encompassing a wide range of methodologies from separation science, sensors, electrochemistry, mass spectrometry and spectroscopy, but also chemometrics and chemical education. This created wonderful opportunities to interact with scientist from fields outside of one's specialty and engage in fruitful discussions.

The conference started with half and full day short courses on various topics, including Chemometrics (***Federico Marini***, University of Sapienza, Italy), Analytical Methods Life Cycle Management (***Marc Roussel*** from France), Nanopore Detection Methods (***Chan Cao*** and ***Juarez*** from the University of Geneva), Membrane Electrodes (***Eric Bakker*** and ***Tara Forrest*** from the University of Geneva), Mass Spectrometry Imaging (***Marchetti-Deschmann*** from the University of Vienna, Austria), Bioanalysis (***Raluca van Staden*** from the University of Bucharest, Romania), Protein Analytics (***Sasa Miladinovic*** from HES-SO Valais-Wallis Sion and ***Jovan Simicevic*** from Philip Morris International Neuchâtel), Paper Microfluidics (***Daniel Citterio*** from Keio University, Japan), Environmental Electrochemistry (***Marylou Tercier-Waeber*** and ***Nicolas Layglon*** from the University of Geneva) and ICP-MS (***Bodo Hattendorf***, ETH Zurich). Professor ***Detlef Günther*** (ETH Zurich) gave an enthralling opening plenary lecture on the history of analytical sciences in Switzerland with insights on more than a century of world class excellence in Swiss analytical sciences. After this ***Uwe Sauer*** (ETH Zurich) was honored with the Simon Widmer Award for his seminal work on dynamic metabolomics, of which he explained the core principles and assumptions and provided numerous biological examples in his award lecture (Fig. 2). The attendees were then invited to a welcome drink generously provided by the city of Geneva, accompanied by live music.

Fig. 2. Prof. Uwe Sauer (right) from ETH Zurich is honoured for his groundbreaking work on dynamic metabolomics with the 2023 Simon Widmer Award, presented at Euroanalysis XXI by the DAS president Eric Bakker from the University of Geneva (left). © Eric Bakker.

On Monday morning ***Sergey Borisov*** (Technical University Graz, Austria) gave a plenary lecture on luminescent sensors, drawing on his rich expertise to showcase principles, molecular strategies and applications, with a strong emphasis on oxygen and pH detection. The optical sensing session then continued with ***Boris Mizaikoff*** (University of Ulm, Germany) on infrared breath sensing while ***Gert Desmet*** (Vrije Universiteit Brussel, Belgium) kickstarted the separations session on the topic of designing perfect stationary phases for liquid chromatography, emphasizing micromachined electroanodized microcolumns. The analytical spectroscopy session was initiated by ***José Amigo*** (University of the Basque Country, Spain) who used chemometrics methods in combination with infrared spectroscopy to assess microplastics in tissues. The mass spectrometry session was started by ***Albert Heck*** (University of Utrecht, The Netherlands) as keynote lecturer who explained charge detection mass spectrometry (CDMS) to simultaneously measure the charge and m/z ratio of single particles including large antibodies to viruses. Invited lectures in these four sessions were ***Dmitri Papkovsky*** (University College Cork, Ireland), ***Li Niu*** (State University of New York, Albany, USA), ***Laura Torrent Fàbrega*** (Paul Scherrer Institut) and ***Martina Marchetti-Deschmann*** (TU Wien, Austria), respectively. After lunch ***Lukas Emmenegger*** (Empa) gave a powerful and entertaining talk on developing and deploying miniature quantum cascade lasers, sometimes mounted onto drones, to probe chemical changes in the atmosphere with excellent precision. This was followed by four parallel sessions, each started by a keynote speaker. Of those, ***Robert Gyurcsanyi*** (Budapest University of Technology and Economics, Hungary, Chemical Sensors Session) introduced novel enabling technologies to improve the affinity of molecularly imprinted polymers by introducing new amino acids as better building blocks, and improved aptamer ligands exhibiting cooperative binding achieved with click chemistry. ***Davy Guillarme*** (University of Geneva, Separation Science Session) described innovative separation methods for monoclonal antibodies, using ultra-short columns and special gradient conditions. ***Sebastian Kruss*** (Ruhr-Universität Bochum, Germany, Spectroscopy Session) talked about near infrared imaging of nanosensors for biomedical applications while ***Laurent Bigler*** (Zurich, Mass Spectrometry) described the development and use of numerous analytical methods to study iron chelators, so-called siderophores that are exuded by microorganisms. Each of the four sessions continued with contributions from the invited speakers ***Agata Michalska*** (University of Warsaw, Poland) and later ***María Jesús Lobo-Castañón*** (Universidad de Oviedo, Spain) in the Sensors Session, ***Lucie Novakova*** (Charles University, Czech Republic) and ***Sasa Miladinovic*** (HES-SO Valais-Wallis, Sion) in the Separations Session, ***Satoshi Kishigami*** (University of Oxford, UK) and ***Davide Bleiner*** (Empa) in the Spectroscopy Session and ***Markus Wälle*** (Swiss Gemmological Institute) for the Mass Spectrometry Session. Between the two afternoon sessions the first of three lively and topically diverse poster sessions took place. In the evening, attendees had the opportunity to choose a social activity, including guided walking tours of the old town of Geneva or the United Nations.

Paola Picotti (ETH Zurich) gave the Tuesday morning plenary lecture and explained with great clarity how conformational changes of thousands of proteins in cells can be identified simultaneously by mass spectrometry, using drug-target interactions as an example application (Fig. 3). The four morning sessions were again started by keynote lectures, with ***Sibel Özkan*** (University of Ankara, Türkiye, Chemical Sensors) focusing on molecularly imprinted polymers for electrochemical sensors. ***Doris Marko*** (University of Vienna, Austria, Food Analytics) gave a detailed analysis of the role of fungal metabolites, known as mycotoxins, in the food chain and their potential role in food toxicity. ***Robbyn Anand*** (Iowa State University, USA, Analytical Nanoscience) explained how the ionic content of microdroplets can be determined with two flowing droplet streams separated by a membrane and an applied potential, while ***Lisa Hall*** (University of Cambridge, UK, Global Health Session) gave an account on using bioengineering together with locally sourced materials such as beach sand, to develop bioassays within resource-poor countries, with demonstrated field studies in Ghana. The sessions continued with the invited speakers ***Felix Zelder*** (University of Zurich), ***Natalia-Maria Christopoulou*** (University of Patras, Greece), ***Marcela Segundo*** (University of Porto, Portugal) and ***Peiheng Wang*** (Wageningen University, The Netherlands).

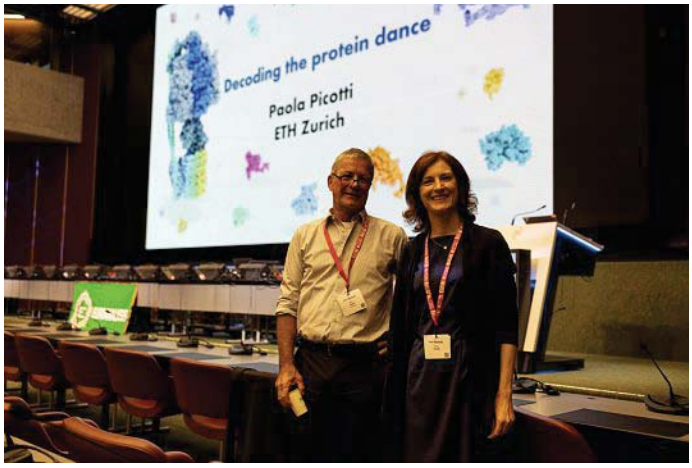

Fig. 3. Prof. Paola Picotti from ETH Zurich, introduced by Marc Suter, gave a plenary lecture on decoding protein interactions with mass spectrometric tools. © Eric Bakker.

Tuesday afternoon started with ***Kevin Plaxco*** (UC Santa Barbara, USA) who showed astonishing results on how electrochemical aptamer-based sensors for the detection of small molecules can be developed and applied in whole blood to trace these target species in real time. Subsequent keynote lectures included ***Susana Campuzano Ruiz*** (Universidad Complutense de Madrid, Spain, Sensors) who talked about electrochemical biosensors with an emphasis on candidate molecular markers in clinical samples and the associated diagnostic value. ***Lenny Winkel*** (Eawag, Environmental Sciences) showed how chromatographic techniques coupled to ICP-MS can be used to better understand speciation and redox cycling of inorganic and organic compounds in various environmental compartments; while ***Alex Gundlach-Graham*** (Iowa State University, USA, Analytical Nanoscience) explained his recent work on quantifying nanoparticles in the environment with ICP-MS by using a droplet microfluidics-based internal calibration approach that overcomes matrix effects. ***Vera Slaveykova*** (University of Geneva, Metabolomics and Proteomics Session) talked about how liquid chromatography-based targeted metabolomics is used to unravel the contaminant-induced effects in aquatic microorganisms. Invited speakers in these four sessions were ***Tom Lindfors*** (Abo Akademi, Finland), ***Todd Martz*** (UC San Diego, USA), ***Thibaut van Acker*** (Ghent University, Belgium) and ***Nikolai Huwa*** (Eawag), respectively. In parallel to these topical sessions, a roundtable discussion on the Greenness of official standard sample preparation methods was held, chaired by the EuChemS DAC chair ***Marcela Segundo*** (University of Porto, Portugal). After a sparkling poster session, there were four afternoon sessions on Sensors, Food, Global Health and Mass Spectrometry that were started by the invited speakers ***Federica Mariani*** (Università di Bologna, Italy, Sensors), ***Slavica Ražić*** (University of Belgrade, Serbia, Food), and

Joshua Smith (Charles University, Czech Republic, Mass Spectrometry). In the evening an opportunity was again given to the attendees to explore Geneva with a guided tour.

Heinz Singer (Eawag) gave the opening plenary of Wednesday morning, which was an impressive talk on high resolution LC-MS instrumentation development for aquatic analysis (Fig. 4). He showed how an instrument can be fitted into a trailer to provide an autonomous go-anywhere solution for the near-real time analysis of pollutants in streams and rivers. The electroanalysis session was then continued by ***Justin Gooding*** (University of New South Wales, Australia) who showed in his keynote lecture how electrochemistry can be used to greatly simplify super-resolution microscopy (Fig. 5). ***Marylou Tercier-Waeber*** (University of Geneva) started the environmental session in her keynote on electrochemical trace level probes for aquatic analysis while ***Daniel Citterio*** (Keio University, Japan) provided insights into paper-based microfluidic devices with an end user focus. The industrial session keynote was given by ***Katherine Bakeev*** (Timegate Instruments, USA) who talked about vibrational spectroscopy for process characterization. The four sessions continued with the invited speakers ***Osamu Niwa*** (Saitama Institute of Technology, Japan), ***Meredith Christine Schuman*** (University of Zurich), ***Jean-Manuel Segura*** (HES-SO Valais-Wallis, Sion) and ***Samual Charles Burnage*** (Novo Nordisk, Denmark), respectively. A fifth session was organized by the EuChemS DAC Chemometrics Study Group headed by ***Federico Marini*** (Sapienza University, Italy).

Fig. 4. Plenary lecturer Heinz Singer from Eawag (left) spoke about developing and deploying high resolution analytical tools for detecting the fate of organic pollutants in aquatic systems. © Eric Bakker.

Fig. 5. Justin Gooding from the University of New South Wales in Sydney before his talk on using electrochemistry to simplify and improve high resolution microscopy. © Eric Bakker.

After lunch ***Gunda Köllensperger*** (University of Vienna, Austria) gave a plenary lecture on how laser ablation coupled to ICP-TOFMS can be used to obtain an imaging platform for metals in cellular organisms while especially formulated microdroplets serve as matrix-matched internal standards. The following keynote lectures included ***Stig Pedersen-Bjergaard*** (University of Oslo, Norway, Electroanalysis Session) who talked about progress in electromembrane extractions as a microextraction technique for ionizable compounds for chromatographic sample preparation. ***Esther Heath*** (Jožef Stefan Institute, Slovenia, Environmental Session) assessed the health risks and chemical uptake of using treated wastewater in agriculture with a range of techniques, focusing particularly on bisphenol S contaminations. ***Ron Heeren*** (Maastricht University, The Netherlands, Life Sciences Session) described novel imaging mass spectrometry approaches for the spatial assessment of biological systems such as tissue, while ***Christoph Meyer*** (Lonza, Industry Session) explained the unique analytical quality control challenges faced in the emerging area of cell and gene therapies. The following invited speakers for the four sessions were ***Simona Baluchová*** (Delft University of Technology, The Netherlands), ***Ralf Kaegi*** (Eawag), ***Rémi Martinent*** (HES-SO, Fribourg) and ***Anuj Shrivastava*** (Indian Institute of Technology) respectively. The third and last poster session was followed by sessions that were started with invited lectures: ***Chan Cao*** from the University of Geneva (Electroanalysis), ***Rosa Marcé*** from Universitat Rovira I Virgili, Tarragona, Spain (Sample Preparation), ***Shu Taira*** from Fukushima University, Japan (Life Sciences) and ***Giovanni Calderisi*** from Bachem (Industry), while a fifth parallel session was organized by the EuChemS Bioanalytics study group headed by ***Raluca van Staden*** (University of Bucharest, Romania). This afternoon was also marked by a great onsite job fair where sponsoring companies were matched up with prospective candidates in short interviews. Springer and the Royal Society of Chemistry teamed up to provide a seminar on publishing later in the afternoon.

Wednesday evening was marked by the gala dinner, the main social event of the conference, which was held at the historic *bâtiment des forces motrices* built over the river Rhone in the heart of Geneva. People enjoyed a welcome drink (Fig. 6) and were then seated in the main hall, accompanied by lively music from a DJ (Fig. 7). After the main course, attendees were treated to a demonstration and subsequently a lesson in tango by a professional couple (Esteban Garcia and his wife Maria), the former also being department secretary at the University of Geneva. Music and dance were enjoyed by many participants and continued until after midnight.

The last day of the conference was started by the plenary lecture of ***Jörg Kutter*** (University of Copenhagen, Denmark) who

Fig. 6. Participants from Switzerland and Fukushima, Japan interacting during the Gala dinner. © Eric Bakker.

Fig. 7. The conference dinner in the bâtiment des forces motrices. © Eric Bakker.

Fig. 8. Antje Bäumner from the University of Regensburg received the Robert Kellner Award and is shown here with Renato Zenobi from ETH. © Eric Bakker.

shared thoughts and opportunities in the field of analytical microfluidics, accompanied by numerous important and emerging applications in this analytical area. The following Electroanalysis Session was started with the keynote lecturer ***Karin Chumbimuni-Torres*** (Central Florida University, USA) who introduced a universal nucleotide-based electrochemical biosensor strategy, the readout of which is independent of the viral RNA sequence. In the Mass Spectrometry Session ***Renato Zenobi*** (ETH Zurich) gave a keynote on the challenges and opportunities of using electrospray ionization – mass spectrometry to detect intact gas phase interactions and introduced Förster resonance energy transfer of trapped gas-phase ions to obtain high fidelity information of gas phase conformation. ***Charles Lucy*** (University of Alberta, Canada, Education Session) gave insights on how to write analytical textbooks of the future, using the upcoming update of his own well-known textbook as an example that will be digital only. Using numerous examples, ***Petra Dittrich*** (ETH Zurich, Microfluidics Session) showed in her keynote how droplet microfluidics coupled to matrix-assisted laser desorption ionization mass spectrometry offers attractive opportunities compared to established MALDI-MS.

These four sessions then continued with the invited speakers ***Peter Hauser*** (University of Basel), ***Johannes Schorr*** (Eawag), ***Gunnar Schwarz*** (ETH Zurich) and ***Stefan Nagl*** (Hongkong University of Technology), respectively. The morning program concluded with two consecutive awards sessions. ***Damià Barceló*** (Catalan Institute for Water Research, Spain) was given the 2023 DAC award by the Division of Analytical Chemistry (DAC) of EuChemS, sponsored by Springer. His talk was on the current topic of microplastics in the environment. ***Antje Bäumner*** (University of Regensburg, Germany, see Fig. 8) was honored as the Robert Kellner Lecture Awardee, also sponsored by Springer. Her talk focused on laser induced graphene for electroanalytical assays and her recognized work on liposome-based analytical strategies. During the closing ceremony the conference flag was ceremonially handed to the Barcelona team headed by Anna de Juan (University of Barcelona, Spain) who has been selected to organize the 2025 edition of the conference (see euroanalysis2025.com).

The organization of the meeting required significant commitment and time, but the many smiling faces and appreciation from the attendees, together with the very high quality of the scientific contributions made this a rewarding effort.

This conference would not have been possible without the generous support of institutional and industrial sponsors. Thanks to the City and the University of Geneva the CICG conference venue was provided free of rental charge, a savings of about 200'000 CHF that kept the registration fee affordable. The Swiss National Science Foundation provided important travel support to a total of 15 international speakers. The Novartis foundation, the Division of Fundamental Research of the Swiss Chemical Society, the Division of Analytical Sciences of the Swiss Chemical Society, the Faculty of Science of the University of Geneva, HES-SO Valais-Wallis School of Engineering, the Zurich Hochschule für Angewandte Wissenschaften, Springer, de Gruyter, the DAC Study Group in Sample Preparation, the Gemeinschaft Deutscher Chemiker, the Italian Chemical Society and the Austrian Chemical Society all provided financial support for this meeting and/or awarded about 45 travel grants for mainly young analytical scientists. Numerous students also supported the conference as helpers in the lecture halls and at the reception in return for free registration. We are also grateful to the numerous industrial sponsors who supported the conference, many of whom came to Geneva to interact with the attendees, conduct interviews and gave scientific talks. They include Metrohm, Agilent Technologies (who also gave scientific seminar on innovative chromatography and mass spectrometry solutions), Bachem, Werfen, Medica, Eaglenos, BGB, Unisense, Drylab-Molnar Institute, Radom, Spectro, Hiden Analytical, Extrasynthese, Macherey-Nagel, Silicon Craft, Vici, and LNI Swissgas. The website of the conference (euroanalysis2023.ch) will remain live for some time to keep the scientific program and the list of sponsors accessible.