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EDITORIAL

Presenting the 2023 awardees of Robert Kellner and DAC-EuCheMS lectures

Congratulations to ABC's Chair Editor Antje Baeumner and long-term ABC supporter Damià Barceló

Nicola Oberbeckmann-Winter[1]

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The 2023 DAC-EuCheMS and Robert Kellner Award Lectures, both sponsored by Springer-Verlag, were held at the EUROANALYSIS XXI conference in Geneva, Switzerland, in August 2023

The DAC-EuCheMS Lecture Award recognizes a European individual who has demonstrated significant and sustained achievements in research or education in analytical chemistry throughout their career. We congratulate **Damià Barceló**, the 2023 recipient of the award, who presented his lecture entitled "Microplastics in the aquatic environment: Green analytical protocols, vectors of pharmaceuticals and risk to biota". The **Robert Kellner Lecture Award** recognizes a European individual who has made substantial contributions in the last five years to the advancement of analytical chemistry research or education. The award was established by the Division of Analytical Chemistry (DAC) of the European Chemical Societies (EuCheMS) in memory of the efforts and achievements of Robert Kellner, in particular towards the consolidation of analytical chemistry in Europe. The recipient, **Antje J. Baeumner**, presented her inspiring lecture entitled "Where nanomaterials can be a unique tool for the improvement of biosensors".

Both lecturers (Fig. 1) talked to Nicola Oberbeckmann-Winter about their research, motivation, and themselves.

Fig. 1 Antje Baeumner (left) and Damià Barceló (right) at the EUROANALYSIS conference in Geneva

What motivated you to become a researcher and what do you find most rewarding in your professional life?

AB: I have always been attracted to science and engineering. The moment I realized that I would actually love research was the first practical course during my university studies in which we were not simply following protocols with known outcomes but were given a research question to be answered. Still to date, this is the one practical course of which I don't only have a fuzzy recollection but a clear-cut memory of experiments done, knowledge gained and excitement felt. Thereafter, it was an easy decision to go into research.

Today, I find most rewarding working with young scientists, teaching them how to become independent researchers leading to the situation that we can engage in scientific discussions of often enough great depth and knowledge, reaching points where I learn from them.

✉ Nicola Oberbeckmann-Winter
nicola.oberbeckmann-winter@springer.com

[1] Analytical and Bioanalytical Chemistry, Springer-Verlag, Tiergartenstrasse 17, 69121 Heidelberg, Germany

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DB: I think I was always going to be a scientist. In this sense the influence of my father was very relevant. He was a high school teacher and he loved mathematics. He insisted constantly on selecting a natural sciences career. A good point that needs to be added is that the selection of a given discipline depends very much on high school teachers. My chemistry teacher for a few years was a disaster but fortunately the previous year to entering the university I had one of the best chemistry teachers in Barcelona – recognized not only by myself but by many others, the late Prof Juan Rion Tomas from Academy Granès. He was the one who motivated my final selection of chemistry instead of biology or pharmacy at the university of Barcelona. Prof Juan Rion was an excellent chemistry teacher and science communicator. Listening to him, chemistry did look to many of us appealing, with daily new discoveries. Afterwards he became a monk at the famous monastery of Montserrat.

The most rewarding aspect of my career was the research freedom I have always enjoyed, especially at CSIC, the National Research Council of Spain. I have loved especially to work with early career scientists. Up till now I have supervised/co-supervised almost 70 PhD theses. It has been a privilege for me to work internationally all my life with students from different parts of the globe like Brazil, Colombia, Argentina, Cuba, Mexico, Germany, Sweden, the Netherlands, Greece, Switzerland, Austria, Iran, Saudi Arabia, France, Italy, India and China. In my laboratories English has been the common communication language always.

From where did you start and how does your current work relate to/differ from your scientific roots?

DB: My current research work started at the University of Barcelona, at the department of analytical chemistry during the years 1977–1984, with my thesis on gas chromatographic developments and applications to organic analysis under the supervision of the late Prof. Luis Eek and Prof. Maria Teresa Galceran. Under the training of both I was learning column packing, adsorption isotherms, and gas chromatography in general. During these 7 years at the University of Barcelona I was also teaching young students, since my contract as Assistant Professor was 50% research and 50% lecturing. The late Prof. Enric Casassas should be added top of the list of mentors. He was the head of department during my PhD thesis, and we had always excellent conversations not only on chemistry but also on the Catalan language and society. I started under his supervision my "second job" as editor of Catalan scientific books at the Institut d'Estudis Catalans– The Catalan Academy of Sciences and Arts. This early training is now much appreciated providing the experience needed for one of my today's activities as editor of several scientific journals in the field of analytical chemistry and environment.

Afterwards I spent 18 months at the Vrije Universiteit in Amsterdam, the Netherlands, working with the late Prof. Roland W. Frei and Prof Udo A. T. Brinkman learning the pioneering work of LC–MS interfacing systems applied to trace analysis of organic pollutants. We did work with an "in-house" direct liquid introduction (DLI) interface at that time since the final interface to be used in liquid chromatography-mass spectrometry (LC–MS) was not yet decided. Another well-known expertise of the Vrije Universiteit was the coupling of pre-column preconcentration and post-column extraction using LC systems. Such couplings applied to LC–MS were developed together when I returned to Barcelona in early 1987. By this time CSIC bought a commercial thermospray LC–MS and I was able to use it for environmental applications using pre- and post-column devices developed in Amsterdam, published together the early papers on such on-line couplings with LC–MS already in early 1990.

This was a good opportunity for me, and I could observe how easy it was to work with commercial LC–MS instruments as compared to an "in house" instrument developed in Amsterdam. Afterwards newer interfaces and instruments were made commercially available like the interfacing system particle beam, electrospray, atmospheric pressure ionization, and new instruments like tandem MS, Q ToF and orbitrap, expanding the possibilities of LC–MS-MS in environmental analysis. To give you an idea if I compare the detection limits of 1987 with the ones that can be achieved nowadays the sensitivity has been enhanced 100,000 times! This is unbelievable and makes nowadays LC–MS-MS a very powerful and universal technique for trace analysis of organics. That being said, I would like to mention that my awarding of the DAC prize is related to chromatography applied to environmental analysis using mainly different types of mass spectrometric detectors.

To summarize here my motivation, I should add that it has been always to develop novel approaches to identify new organic pollutants in the environment and to better understand their fate and toxicity when mixed with nanomaterials and micro/nanoplastics in the environment. As a comparison I always use the Sherlock Holmes approach, I am always looking for new discoveries that maybe a "hidden" problem. In this sense during my research years, I have been identifying and studying the behaviour of a comprehensive list of organic pollutants like pharmaceuticals, pesticides, surfactants among others as well as nanomaterials and micro/nanoplastics in water and soil compartments. Evaluation of the risk to biota of such complex environmental mixtures is still a challenge and I do believe it will continue to grow in the next coming years. Recently non target screening is widely used for the detection of unknown chemicals in combination with powerful chemometric tools, also named "bio-informatics".

AB: I started studying biotechnology, which at that point would be better described as molecular bioengineering, encompassing one-third engineering, one-third chemistry and one-third molecular biology. I loved bioprocessing during my studies, but through master's, doctoral and postdoctoral research entered the field of bioanalytical chemistry

with a focus on biosensors, miniaturized analytical systems and nanomaterials. During my time at Cornell University, I taught biological engineers initially about biotechnology and later had the chance to teach the sophomore introductory class in which various bioengineering and environmental engineering topics were discussed. In Regensburg, this shifted, and I teach analytical chemistry to sophomores, so that my research and teaching are much more closely related. Master's level courses obviously always dealt with sensors. Yet, coming full circle also research-wise, I have the privilege of just having started as Director of the Fraunhofer Institute IZI Branch of Bioanalytics and Bioprocessing in Potsdam while retaining my chair in analytical chemistry in Regensburg. Thus, both of my research interests are now part of my daily research life.

Please summarize the focus of your award-winning research and what was/is your motivation?

AB: My research is driven by the motivation of solving analytical challenges at the point-of-care, on-site and in-field through miniaturized biosensors and bioanalytical systems. Important in almost all of our research questions is keeping applications and hence real-world samples and their matrices in mind. We started to develop, study and optimize nanomaterials to help us address challenges where bulk materials or mere molecules don't suffice. While I started using liposomes for signal amplification already during my doctoral research, we have added 2D nanomaterials and nanofibers. Through colleagues in my research team, I also incorporated nanoparticles into our portfolio over the last 10 to 15 years. We develop these for sample preparation, signalling and as transducers. While my initial work was focused on food safety and environmental monitoring, clinical diagnostics has been of equal importance recently with interests in the point-of-care measurements in general, infectious diseases and especially also the complement system.

DB: My current research lines today are: wastewater-based epidemiology (WBE) using environmental proteomics and high resolution mass spectrometry, analysis, fate and advanced removal technologies of emerging contaminants in the aquatic environment and analysis and risks of micro/nanoplastics in aquatic and agroecosystems. The lecture of the DAC-EuChemS award was devoted to the last research topic. In this sense microplastic analysis and standardization has not yet been solved with multiple analytical techniques a being used. In our network of laboratories, we use mainly micro-FTIR and pyrolysis gas chromatography-mass spectrometry. My motivation was always to deeply investigate new environmental problems – with the focus on trace organic contaminants and materials, like micro/nanopolastics – in water, soil and biota compartments. The discovery of such new problems as well as to better understand the fate, including sorption, bio-accumulation, risks and remediation has been my main motivation of my research along the years.

What is the trickiest problem you have had to overcome in that research? How did you solve it?

DB: This is really a difficult question, indeed. I should indicate that the early times of LC–MS development, in 1985–1986 working at the Vrije Universiteit in Amsterdam with DLI interface were the most difficult times from the technical point of view. We could work maximum of a couple of days with the same capillaries/tubing and afterwards we needed to clean up and change all the capillary tubing. In addition, mass spectrometers were not really designed to accommodate liquid phases of acetonitrile, methanol and water, even using, micro-LC columns, so we needed to check all the time the pump pressure and be aware that the whole system may stop at any time. To obtain reproducible LC–MS chromatograms was a nightmare, mission impossible for several days! Things changed completely when in 1987 I was able to work with a commercial LC-thermospray MS. This was a robust interfacing system that could be used daily on a routine basis. This was the consequence of years of collaborative work of university researchers and LC–MS manufacturers. The final and definitive interfacing system was electrospray MS that I was able to purchase during the early 90s and changed completely the LC–MS world. In my own laboratories we were able to determine trace organics at lower detection limits and to identify more polar and thermally labile compounds as well. The basic principle to achieve such better performance was that the ionization was direct from the liquid phase to gas phase avoiding the excess heat of previous interfacing systems and obviously no thermal degradation at the interface was observed.

AB: Developing biosensors that work at low detection limits in complex matrices, that are as easy-to-use as a rapid test, yet provide quantitative results, and are easy-to-produce at low cost. And, no, we did not solve it yet.

Where do you consider your field is heading?/Which recent discovery might prove most valuable to the field of bioanalytical research or beyond?

AB: I think that in the point-of-care field we are heading more and more toward wearable, and even intelligent, sensors; and toward nucleic acid-based rapid tests. Both of which suggest that we will have to address sample preparation strategies to be an integrated element of such sensors.

DB: Non target analysis and bio-informatics seems to be the necessary tools for the future, but an old problem still remains in the field of environmental analysis and it is the lack of standards of newly identified chemicals like transformation products of emerging contaminants. With high-resolution MS we can discover large amounts of new chemical compounds but many of them can only be identified tentatively due to the lack of commercially available standards. I can understand that for chemical manufacturers this is not an easy question to solve since they cannot synthesize hundreds of new chemicals that will not be able to

sell at large quantities. In short although LC-tandem MS and high-resolution MS are nowadays very powerful, being able to detect hundreds of compounds at low levels, we still miss the final authenticity of the compound tentatively identified by MS due to the lack of standards.

Lastly, I would like to add few words about environmental proteomics. In addition to the presence of small molecules in the environment, the characterization of large molecules like proteins and peptides is providing additional information valid not only for the performance of wastewater treatment plants (WWTPs) but also for detecting and mapping the various industrial activities such as the ones of the veterinary sector as well human health diagnostics in a given area. With the recent pandemic, SARS-CoV-2 proteins N or S were identified in WBE from Covid-19 infected population. Environmental proteomics also allows to identify the unique peptides of the rat and mouse proteins present in the sewage and parks of big cities, being a useful tool to better understand and solve public health problems.

What are the opportunities for your generation in analytical and bioanalytical chemistry?

DB: My generation was very lucky with the development and avalanche of bioanalysis. Let's say I started as independent researcher around 1990s up till now, and during that period biosensor development, especially with new nanomaterials has achieved great success and many research groups and institutes were created around the globe. I have seen how the analytical chemistry instrumentation has achieved its maturity and it was transferred to more commercial instruments. Simultaneously research laboratories started to develop and apply bioanalytical tools to solve different problems, mainly applied to health-related issues. During this period, we have seen the tremendous development of proteomics as well applied mainly to medical research. In addition to instrumentation developments the new materials like graphene, fullerenes, and carbon dots permitted substantial advances in analytical and bio-analytical chemistry around the globe with many applications in health, food and environment.

In your opinion, does/did your generation have to respond to the publish or perish "pressure" and what is your advice for young analytical scientists today?

AB: As a doctoral student, I did not feel pressure other than producing good science that is worthy of being published. Once a postdoc, and certainly as a tenure track professor, the pressure of high-quality research and publication was obviously high. Measures may have been slightly different then, but quality and quantity have also always been a most important measure in my entire career. My advice to young analytical scientists today is to do really good science, to find mentors whom you can also use as a sounding board for your ideas, and while building a scientific network, try to reasonably quickly find those peers with whom science is fun, productive, and far-reaching.

DB: Publish or perish is still valid nowadays and it will be valid in the years to come. We know that ambition and competition are necessary ingredients for productivity and quality and most importantly, most of the governmental agencies of evaluation of grant proposals and promotion of personnel will look to the CV of the candidates. The main criteria are quantity and quality, all researchers around the globe are asked to publish a certain number of papers in SCI journals of high impact factor, and afterwards then global rankings are being made. The quality control on the performance is generally made, firstly, by this parameter. But this is not the only criteria, usually in all evaluation committees other criteria are as well very relevant: how many projects a given researcher was able to manage during the last years and the teaching skills. Importantly, what kind of services a given researcher has been offering to his/her institute or university, like for instance general talks to the public, NGOs, social media and communication performance in general is also considered when evaluating a candidate for new position or promotion at the university.

Last point to be added in this question is that during my generation we have seen the big explosion of Chinese research. I am often in China where at present there are 3000 universities with a high degree of competence and state-of-the art instrumentation. The top universities in China are considered among the best of the world in different areas and I have seen the work carried out by Chinese research scientists. In short, my generation was the first to establish formal collaboration with China. For Chinese scientists "publish or perish" is extremely relevant, like for us in Europe or the US. To this end I would like to add that Indian researchers need to be on our radar as well. Myself I have an ongoing collaboration with India as well and I see how the country and the universities are slowly but step by step progressing. I do believe that in 10 years' time several Indian universities will be at the top world ranking, following always "publish or perish" flagship.

And finally, talking not only to the researcher: what do you enjoy most when you have time to spare?

DB: I hope to remain interested in science during the next coming years. In this respect the late Professor Wilheim Fresenius (1913–2004) is an excellent example, as mentioned by Prof. Freddy Adams, also winner of DAC-EuChemS. Award, Prof. Fresenius was a good friend of my Vrije Universiteit mentor Prof. Roland W Frei and I had the chance to talk and have dinner with him several times with always encouraging conversations and experiences.

That being said, I should add that science is my main interest and even during holidays I need to spend few hours reading papers or looking at my dashboard as editor of several journals and books. But apart from science, I like to travel and visit museums – together with my wife we are members of the National Gallery in London – and several other museums in Spain, and art in general. We visited many of the Frank Lloyd houses in the US, including his original place

in Taliesin, Spring Green Wisconsin. I do believe that Frank Lloyd is one of the greatest architects of all time. Apart from that I also like movies in general and sports, especially basketball, cycling and tennis. We have also followed Eric Clapton for a few years and we try to attend each year one of his concerts in the UK, he is our preferred artist. In general, we like pop-rock-blues music too. Lastly, I am going to the gym 3–4 times a week as a way to keep me in good health conditions and I believe that it is better to spend the money in the gym that taking more pills. We like as well good food and a few times a year we visit one Michelin star restaurant located in Lleida Spain, the place where I was born. It is highly recommended, with a mix of local specialities and high-level cuisine, and most importantly a friendly atmosphere.

AB: I love biking and running, and I do so every day. I may not be fast or competitive anymore, but I enjoy the fresh air, the free flow of thoughts while biking/running and the exhausting exercise felt throughout my body. I also very much enjoy playing the piano, but have far too little time for it, reading a good book, cooking and enjoying a delicious meal. Most of all, I love spending any spare time with my family (and hence tend to run while they are still asleep – call me an early bird).

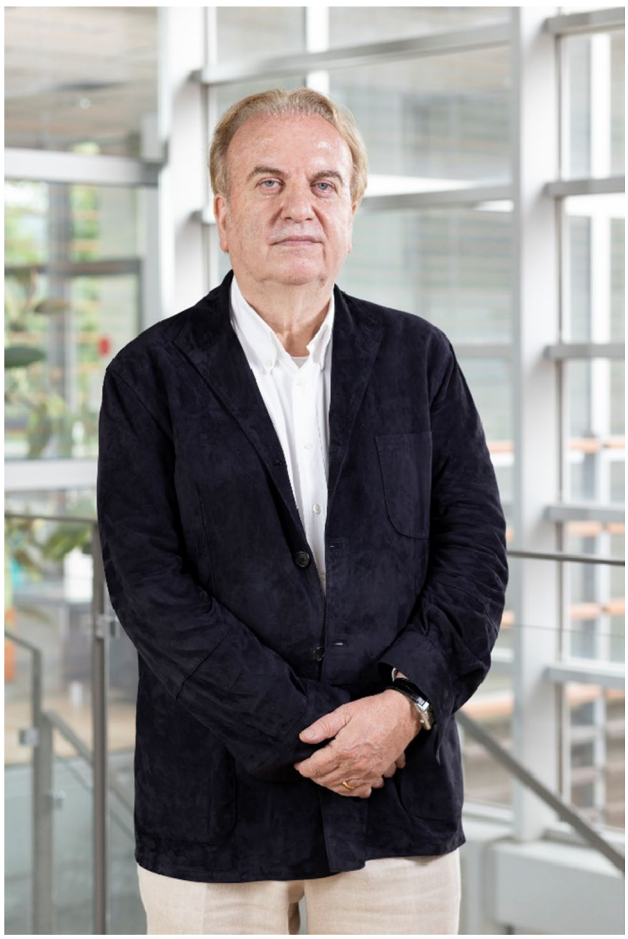

Fig. 2 Damià Barceló

Thank you for these fascinating insights and sharing your thoughts with us!

Damià Barceló (Fig. 2) has been Full Professor at IDAEA-CSIC, Barcelona, Spain, since 1999. From 2008 to 2023, he was Director of ICRA, Girona, Spain, and from 2016 to 2023, he was Visiting Professor at King Saud University, Riyadh, Saudi Arabia. In 2024 he was appointed Honorary Adjunct Professor at the University of Almeria. He was awarded Doctor Honoris Causa by the University of Ioannina, Greece, in 2014; by the University of Lleida in June 2021; and by the University of Almeria, Spain, in May 2022. He was Honorary and Guest Professor at ZAFU, Hangzhou, China, from 2019 until March 2022 and Foreign Expert of East China University of Science & Technology, Shanghai, China, 2021–2022. From January 2022 until December 2026, he was Adjunct Professor in the Sustainability Cluster, School of Engineering, at the UPES, Dehradun, India. He has received awards including the 2023 DAC-EuCheMS Lecture Award, the King Hamad Prize for Agricultural Development in the category of Best Agricultural Research & Studies, the 2012 Recipharm Environmental Award, the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW), the 5th Award on Water Management & Protection, and the 2007 King Jaime I Prize for the Protection of Nature. He has supervised >65 PhD students and delivered short courses at PITTCON, SETAC NA, and ExTech conferences. Since 2010, he has been listed as an ISI Highly Cited Scientist, with an H-index of 181, over 145,000 total citations, and more than 1675 publications. In 2023, Research.com ranked him as 3rd and 23rd environmental scientist and chemist, respectively, in the world. He has been co-editor in chief and editor of the journals STOTEN, GREEAC, TRAC, Methods X, CSCEE, and COESH; editor in chief of the book series *Comprehensive Analytical Chemistry*; and co-editor in chief of the book series *Handbook of Environmental Chemistry* and *Advances in Chemical Pollution, Environmental Management and Protection*. To date, he has been editor and co-editor of 39 books on environmental chemistry. His expertise lies in the analysis, fate, risk, and removal of emerging contaminants, nanomaterials, and microplastics from water, as well as sewage epidemiology of drugs and proteins using advanced mass spectrometry techniques.

Fig. 3 Antje J. Baeumner (Acknowledgements to S. Dölle)

Antje J. Baeumner (Fig. 3) is Director of the Institute of Analytical Chemistry, Chemo- and Biosensors at the University of Regensburg and remains Adjunct Professor in her former home institution, the Department of Biological and Environmental Engineering at Cornell University in Ithaca, NY, USA. Since 2023, she has also been Director of the Fraunhofer Institute Branch of Bioanalysis and Bioprocesses (IZI-BB) in Potsdam. She is Chair Editor of the Springer Nature journal *Analytical and Bioanalytical Chemistry*. Among the several conferences she organized, she was most recently chair of the 2022 Gordon Research Conference on Nanotechnology for Agriculture and Food Systems. Her research is focused on the development of biosensors and microTotal Analysis Systems for the on-site detection of pathogens and toxins in food, the environment, and for clinical diagnostics, with special emphasis on the development of novel nanomaterials. Her impact in the scientific community was recognized early on by being a Blavatnik Award finalist and more recently by receiving the 2023 Robert Kellner Lecture Award from the Analytical Division of the European Chemical Societies.