Analytical science in Germany—method developments and new applications at high international standards

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As usual for industrial nations such as Germany, the analytical sciences are implemented in many different branches, such as high technologies, the natural and life sciences as well as environmental technology. Whereas routine methods are usually applied at the highest international standards in corresponding laboratories in industry or in independent analytical laboratories, most of the innovative developments in analytical science are carried out in research laboratories of universities or research institutes such as those of the Max Planck Society, the Fraunhofer Society and the Leibniz Association. In this case analytical science is not only associated with analytical chemistry but also with physics, biology, geology and medical departments and those of material sciences. This broad distribution of analytical activities is also reflected in this special issue of *Analytical and Bioanalytical Chemistry*. However, even though many different scientific fields contribute to innovative developments and new applications in the analytical sciences, a major activity is focused on research laboratories in analytical chemistry that have traditionally made substantial contributions to academic education in German chemistry faculties. Unfortunately, the influence of analytical chemistry as a ‘minor field of study’ in chemistry

studies is decreasing in Germany, so the general importance of this branch of study must be made more obvious to the scientific community and also to the general public.

In the past, analytical chemistry played a more important role in chemistry studies at German universities. The University of Leipzig, the Johannes Gutenberg University Mainz and the Eberhard Karls University Tübingen are only three of many important centres where many innovative analytical activities were carried out, and from where internationally well known analytical chemists have emerged. A tribute to one of these academic teachers in analytical chemistry from the University of Mainz, Prof. Rolf Neeb, is therefore published at the beginning of this special issue to commemorate the 80th anniversary of his birth in 2009. Rolf Neeb was an internationally well known analytical chemist in the field of electroanalytical chemistry and received his diploma under the supervision of Wilhelm Geilmann, another very important person in the German history of analytical chemistry. Also the Editor of the Fresenius’ Journal of Analytical Chemistry, Prof. Wilhelm Fresenius, was Honorary Professor of this university. During his life time he contributed greatly to the development and success of analytical chemistry in Germany.

Recently, in German universities a pilot project has been evaluated to establish strategies to compare different faculties within a university and to rank them within the scientific community. Overall, chemistry demonstrated a very high standard internationally, underscoring the traditional interest in German postdoctoral researchers worldwide. However, in the final statement of the evaluation group, analytical chemistry in Germany was attested as having low visibility and only a fair reputation. This conclusion was unsatisfactory both to German analysts and to the Division of Analytical Chemistry within the German Chemical Society. Their representatives wrote a

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letter of complaint to the evaluation team, to which they did not receive a response. We realised that as research groups of analytical chemists are generally located within inorganic, organic or physical chemistry departments, our publications, patents and international connections were allocated to these branches of research. Therefore, we chose not only to argue with this evaluation assessment, but also to demonstrate the high standard of German analytical chemistry by editing a special issue of *Analytical and Bioanalytical Chemistry*. We invited many research groups at universities and research institutions and even some groups doing analytical research outside chemical faculties. We feel that the outcome better demonstrates the high standing of analytics in Germany than the above-mentioned conclusion of the German Council of Science and Humanities (Wissenschaftsrat).

Because of our intention to demonstrate the breadth of analytical research and our invitation to scientists in non-chemistry institutions, the reader will find in this special issue a very broad survey of current methods and applications. We feel that they illustrate that analytical chemistry is not a service science for other fields of research, but rather requires an experienced, well-educated, open-minded scientist, who performs his/her job not as a sideline and has the ability to judge the strength of competing methods, is critical in his/her experiments and is meticulous in performing validity control. More than 30 papers endured the stringent peer-review process you are familiar with in this journal. Recent advances in many chromatographic and spectroscopic methods are reported in this special issue. Applications range from classic analytical problems to the forefront of proteomics and effect-based analytics using nuclear receptors. Array technologies for high-throughput or high-content screening are presented here. Imaging techniques and sensor arrays as well as cell-based assays are covered in several papers, as are optical and electrochemical detection principles that have been improved or adjusted to new requirements. Hyphenated techniques as well as analytics in process control are further important topics considered in the papers included. Particularly interesting is the combination of the detection principle, the multianalyte problem and chemometrics to approach solutions in complex matrices.

Examples from the forefront of analytical research are presented in this special issue. We thank all the authors for their overwhelming response to our invitation and their contributed papers. Gratefully, we acknowledge the support of the editorial office during the review and publishing process. We hope that this special issue will help to overcome the tendencies at least in Germany to consider

analytical science as not really a true research area but one in which each colleague feels qualified to use commercial equipment to analyse samples. We suggest that similar special issues for other European countries may help raise the reputation of analytical scientists and may be of assistance in obtaining European funding.

Günter Gauglitz is Professor at the Eberhard Karls University Tübingen working in analytical and physical chemistry. He has been chairman of the GDCh Division of Analytical Chemistry and chaired the Europt(r)ode VIII meeting. For the last 10 years, his main scientific interests have centred on research and development in the area of chemical and biochemical sensors with special focus on the characterisation of the interfaces of polymers and biomem-

branes by surface spectroscopic techniques, the application of spectral interferometry to monitor changes in the optical thickness of thin layers and the effects of Fresnel reflectivity at interfaces. Since 2002 he has been an editor of *Analytical and Bioanalytical Chemistry*.

Klaus Gustav Heumann is Emeritus Professor of Analytical Chemistry at the Johannes Gutenberg University Mainz. His research interests lie in the development and application of analytical methods for the determination of trace elements and trace amounts of elemental species, using inductively coupled plasma mass spectrometry, thermal ionisation mass spectrometry, different types of optical atomic spectrometry, and electroanalysis as detection meth-

ods, and high-performance liquid chromatography, capillary electrophoresis and capillary gas chromatography as separation methods. He has received several awards, including the Clemens Winkler Medal of the German Society for Analytical Chemistry in 2004 for his scientific lifework and for continuous support of analytical chemistry in Germany. In 2007 he received the European Award for Plasma Spectrochemistry. He is a member of several national and international scientific societies and he was a member of the IUPAC Commission on Atomic Weights and Isotopic Abundances for 12 years and chairman from 1991 to 1995. Since 2002 he has been an editor of *Analytical and Bioanalytical Chemistry*.