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EUROPEAN ASSOCIATION FOR CHEMICAL AND MOLECULAR SCIENCES

EUCHEMS NEWS

European analytical column No. 36 from the Division of Analytical Chemistry (DAC) of the European Association for Chemical and Molecular Sciences (EuCheMS)

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INSTEAD OF INTRODUCTION – A MESSAGE FROM THE CHAIRMAN OF DAC: "A FOCUS ON EDUCATION"

The European Analytical Column has a somewhat different format this time. From now and on, it is our ambition to invite a guest columnist to give her/his views on various matters related to Analytical Chemistry in Europe. This year we have invited Prof. Hendrik Emons of the Institute for Reference Materials and Measurements (IRMM) to give his perspectives of Analytical Chemistry with inputs obtained from colleagues at the same institute. Recent activities of DAC and changes of its governance are also reported.

Analytical Chemistry in Europe has many facets and the Division of Analytical Chemistry, DAC, is discussing a broad range of them. I would like to focus my introduction of this European Analytical Column to one question:

Do we need analytical chemists with high quality education?

More than every second chemist working outside the educational system in the world is an analytical chemist. This factual circumstance is neglected in most European countries. If Europe wants to be competitive with respect to its industrial activities based on chemistry, then a comprehensive and advanced education of skilled analytical chemists becomes crucial.

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A high quality education in analytical sciences assumes a platform of high quality research. Unfortunately, the various governmental financing of research in analytical sciences in Europe neither reflect nor meet industrial needs. The grants that are given to analytical chemists are marginal and heavily disproportional in comparison with other branches of chemistry. Consequently, there are too few high quality research platforms in analytical chemistry in Europe.

The recruitment of qualified analytical chemistry researchers at universities is hampered by the fact that most industries can offer a skilled Ph.D. in analytical chemistry a much more attractive environment than that of a university.

The recent developments in analytical sciences have provided a broad spectrum of tools and techniques. It is often difficult to find an expert and an appropriate education in a certain analytical discipline in some European countries. The position of analytical chemistry in Europe could be improved through the formation of research networks, arrangement of advanced courses and conferences, *etc*. This is a challenge for us within DAC and EuCheMS during the coming years. A great deal has already been accomplished through the excellent work of Reiner Salzer regarding guidelines for the content of education in analytical chemistry at the B.Sc. level (Eurobachelor).[1]

THE PERSONAL VIEW OF H. EMONS ON PERSPECTIVES FOR ANALYTICAL CHEMISTRY

What an exciting time for analytical chemistry: the demands for information about the interrelations of chemical composition – structure – properties for natural and synthetic materials are exploding. Analytical data are requested in the spatial domain from the atomic/molecular scale within biological structures *etc*., to the scale of global earth observation and in time windows from femtoseconds in laser applications to millions of years for palaeoclimate research. An increasing number of production processes have to be controlled by on-line analysis. The rapid development of technologies with the prefixes "nano" and "bio" could not have occurred without analytical tools from scanning probe microscopies to LC–MS^n.

In particular, the progress in the so-called bio- and nano-sciences is often driven by ideas, as well as by experimental and theoretical approaches, which are based on multidisciplinary knowledge and cross-fertilization among different scientific fields. This has led to "identity" and image problems in traditional scientific disciplines and could complicate the attraction of bright students and junior scientists, as well as research funding and academic positions. Such detrimental effects for analytical chemistry have been observed in several European countries in the last few years.

However, do those phenomena really reflect a downhill trend of analytical chemistry? Let us just look into a few aspects of the bio- or life-sciences: The “omics” are creating more chemical (molecular)-oriented analytical requests from

biology and medicine than ever before. For instance, proteomics research is stipulating significantly the further development of mass spectrometry and affinity assays. Analysis at the cellular and tissue level requires the drastic reduction of sample sizes, the controlled preparation of delicate, not very stable samples and improved detection capabilities, including simultaneous multi-analyte quantification. The search for crucial human biomarkers is one of the most challenging tasks in clinical chemistry and can only be performed with powerful analytical tools and concepts. New non-invasive methods are required for early tissue diagnosis without biopsy and for the acute monitoring of disease treatments, such as those of cancer therapy.

In addition, the current "nano-wave" is pushing material sciences not only much closer to atomic and quantum physics, but also into many areas of chemistry, including modern analytical chemistry. For instance, the present discussions about possible health effects of some engineered nano-particles cannot be reduced to correlations of toxicological phenomena with morphology characteristics and will certainly in the future involve more chemical surface analysis at the nanoscale.

Obviously, there is not a shortage of exciting problems for analysts in many areas, both with cutting-edge scientific dimensions and with high social and economic relevance. There are, however, awareness issues both within the analytical community and with respect to the perception by scientists from other disciplines, and of regulators, the media, the public *etc*. According to my experience, a "simple" request from an "outsider" to an analytical chemist that he should just perform a "routine" service by analysing a provided sample with respect to pre-specified parameters develops nowadays much more often into a fruitful scientific discussion and collaboration about defining together the analytical problem and on designing the measurement strategy which really could allow the original question to be answered. Consequently, being able to use a mass spectrometer or a DNA sequencer does not make you an analytical chemist! Today, the analyst as a respected and valued scientific partner has to know and apply a range of analytical principles for identifying (often together with other specialists) the crucial measurand(s) for the question of interest, for establishing the metrological traceability and estimating the inherent uncertainty of the provided analytical data. This requires an adequate education on generic principles of analytical chemistry, including the basics of statistical data evaluation, method validation, estimation and use of measurement uncertainties, systems for lab-internal and external quality control, *etc*.

There was – and still is – a strong tendency in many scientific areas, for instance in genomics or proteomics, to establish large collections of analytical data without appropriate assessment of their reliability and/or without sufficient documentation on data validation. Obviously, the efforts towards data quantity

and data quality, respectively, have to be re-balanced. This problem should also be considered seriously in the reviewing process of manuscripts prior to publiccation. I am not asking for a revival of the editorial principles of Justus von Liebig in the 19th century, who accepted for the journal "Annalen für Chemie und Pharmacie" only manuscripts in which the described experiments could be successfully repeated in his own laboratory. Nevertheless, there are still too many papers published which claim to establish new analytical methods and procedures but fail to convince the discerning reader about their proper validation or which report analytical data but do not provide convincing quality assurance information.

Obviously, the teaching and practicing of principles of analytical quality assurance and control (QA/QC) should be dealt with in a systematic manner at more European universities. Personally, I do not favour separate courses on QA/QC, but rather would prefer the integration of such generic concepts and procedures into the analytical lecture courses and laboratory exercises that are teaching methods and applications. By this means, a more practical, use-oriented quality knowledge and culture can be embedded in the young generations of analysts, instead of boring them with a definition- and regulation-focused "*l'art pour l'art*" approach to QA/QC. Such an education would also reduce to some extent the difference between curiosity-driven research in academics and the job content of many graduates of analytical chemistry in industrial laboratories or those of regulatory bodies. The latter two often put much more emphasis on quality management and compliance with international standards, such as ISO/IEC 17025, a topic that may not even be known to some university teachers or graduates.

Many projects for analytical chemistry are currently driven by challenges from the implementation and monitoring of legislation. Indeed, there is an increasing demand for scientifically sound, reliable analytical data for regulatory decisions at both the European and the global level. For instance, the new EU Water Framework Directive requires the development of analytical procedures for new specified analytes, such as short-chain chlorinated paraffins, in various types of water. Methods with improved precision are required for measurements around the legal limits – just think about decisions concerning the acceptance or rejection of food imports such as nuts because of their mycotoxin levels. There are needs for robust methods required for controls outside the laboratory (*e.g.*, at customs) or for large-scale screening of products or the environment, as well as for confirmatory/referee laboratory analysis in cases of dispute settlements. As the same analytical procedure is rarely suited for all the different purposes, the demanded variety will keep many of us busy for years to come.

Without being in possession of a crystal ball, near future advances in analytical chemistry can be predicted in a number of general directions. These include the further pushing of performance limits of analytical methods (such as smaller "target" sizes to achieve high spatial resolution, faster analysis for real-time

or high-throughput data), simultaneous multi-parameter analysis of increasingly complex systems (living organisms, ecosystems, *etc*.) including their non-target screening, progress of non-invasive methods, provision of "sustainable" analytical data with demonstrated reliability (both precision and trueness) which are suitable for the purpose of making qualified decisions. Moreover, the miniaturesation of devices, laboratory automation and on-line process analysis are likely to continue as trendsetters. Above all the abilities of well-trained and continuously updated analytical chemists to combine their specific competences with interdisciplinary approaches in a problem-solving oriented manner are providing our discipline with a bright future!

NEW DAC GOVERNANCE

Heiner Korte, Germany, resigned as Secretary for the Division of Analytical Chemistry (DAC) after nine years of service. His successor, Jens E. T. Andersen, Denmark, was appointed at the 2007 Annual DAC meeting in Antwerp for the period 2008–2010. Heiner efficiently served under two Chairmen during the period 1999–2007 and due to his professsional contributions to the current structure and organisation DAC has gained wide respect and appreciation in the European analytical chemistry community and amongst his EuCheMS colleagues. The DAC Steering Committee was also appointed at the Annual meeting: George Horvai, Hungary, Wolfgang Buchberger, Austria, Paul Worsfold, UK, Jens E. T. Andersen (Secretary), Denmark, and Bo Karlberg (re-elected Chairman for the period 2008–2010), Sweden. At this meeting, it was also decided that DAC support the continuation of the Study Group of quality assurance. Jens E. T. Andersen took over from Wolfhard Wegscheider after his long-time effort as head of the Study Group. Jens E. T. Andersen was also appointed as the liaison person to EuraChem and to CITAC.

INFORMATION FROM THE **E**U**C**HE**MS** DIVISION OF ANALYTICAL CHEMISTRY

The Euroanalysis conference is the main event of the DAC, and it was excellently organised by Koen Janssens and Luc Van't Dack under the auspices of the Flemish Chemical Society KVCV. The conference was held under the general theme “The role of Analytical Chemistry in the preservation of mankind’s natural and cultural environment”. It was attended by 650 participants from 50 countries worldwide providing more than 800 contributions. The stimulating scientific program, including a fully booked poster sessions, was interspersed with interesting booths of instrument manufacturers and publishers. Prof. Alfredo Sanz-Medel of Oviedo University in Spain gave the “Robert Kellner Lecture”, which was sponsored by the Springer Verlag. “The Merck Award” was awarded to Alexander Makarov of Thermo Finnigan for his development of the orbitrap analyzer of mass spectrometry and to Prof. Shuming Nie of Georgia Institute of Technology for introducing quantum dots to clinical analysis and diagnosis. Euroanalysis XV, with the motto “The impact of Analytical Chemistry on the Quality of Life” is planned for Innsbruck on September 6–11, 2009, and is now accessible at www.Euroanalysis2009.at.

In 2008, the DAC will contribute to the second general conference on Chemistry in Turin, 16–20 September. The DAC focuses on metrology in chemistry and thus promotes its continuing effort within the field of quality assurance. Prof. Manfred Grasserbauer will present a lecture entitled “The Environmental Challenge for Analytical Sciences”. This will continue the process of involving the work of analytical chemists from the public sector, industry and academia in the DAC.

Europe has played a central role over the centuries in developing analytical chemistry and Prof. Duncan Burns continues his effort within the frames of the DAC with "Contributions to the History of Analytical Chemistry in Europe made *via* DAC–EuCheMS". This work resulted in several publications, including, with L. Sabattini, an account of the History of Analytical Chemistry of Italy, publicshed this year preceding the conference in Turin 2008.

It is important to the DAC to maintain networking with the other Divisions of EuCheMS, which are occupied by corresponding scientific issues. The cooperation is fostered by appointing liaison persons who relate to education, history, life sciences, food, environment, electrochemistry, computations, microsystems, IUPAC and Eurachem. The developments of quality assurance and quality control are followed with great interest because these subjects have a profound impact on a wide range of applications that are also considered and supervised by the European commission. Although highly specialised conferences are increasing in numbers and popularity, it is important to communicate actively across the borders defined by technologies, which ensures a high level of science, education and innovation. The contact to other divisions, to supranational boards and to non-European societies is aided by DAC observers. Updated information on DAC activities may be found at www.dac-euchems.org.

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REFERENCE

1. R. Salzer, *Anal. Bioanal. Chem.* **378** (2004) 28.