Congress Report

Hyphenated mass spectrometry - indispensable in clinical and forensic toxicology and in doping control

Analytica Conference 2008 - Joint Symposium with GTFCh and IATDMCT on Munich (Germany), April 2, 2008

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Since 40 years, the Analytica Exhibition is a leading trade fair for analytical equipment and solutions, laboratory technology and life science applications. In parallel, the Analytica Conference is organized by the German Chemical Society (GDCh), the Association for Biochemistry and Molecular Biology (GBM) and the German Association for Clinical Chemistry and Laboratory Medicine (DGKL). Since many years, Professor Hans H. Maurer has been regularly invited by the GDCh to organize one of the symposia on behalf of the German speaking Society of Toxicological and Forensic Chemistry (GTFCh). He has always organized this symposium as joint symposium with other national and international scientific societies, this year with the International Association of Therapeutic Drug Monitoring and Clinical Toxicology (IATDMCT), of which he is currently President. Together with his co-chairman Professor Hemmersbach from Oslo, he could welcome about 100 participants at this year's symposium making it the best attended this year. Well known international experts (Figure 1) spoke on different aspects of hyphenated mass spectrometry as an indispensable technique in clinical and forensic toxicology and in doping control.

Fig. 1: Symposium Speakers (left to right): Willy Lambert, Franco Tagliaro, Hans H. Maurer, Peter Hemmersbach, Jordi Segura, Mario Thevis

Prof. Dr. Willy Lambert, Laboratory of Toxicology, Ghent University, started with an interesting overview on the latest progress in sample preparation for hyphenated mass-spectrometry. He critically reviewed the pros and cons of different sample preparation techniques start-

ing with classical liquid-liquid and solid-phase extraction, continuing to liquid-phase microextraction, liquid membrane extraction, supercritical fluid extraction and finally to extraction techniques using immobilized antibodies, molecularly imprinted polymers and restricted access materials. A discussion of automation and miniaturization closed Lambert's presentation (for details: Wille,S.M.; Lambert,W.E. (2007) Recent developments in extraction procedures relevant to analytical toxicology [review]. Anal.Bioanal.Chem. 388:1381).

Prof. Dr. Dr. h.c. Hans H. Maurer, Department of Experimental and Clinical Toxicology, Saarland University, Homburg/Saar, continued with a critical review of the possibilities and limitations of LC-MS in Clinical and Forensic Toxicology. He discussed concepts and procedures from confirmation of immunoassay results, drug of abuse testing by "dilute and shoot" procedures, target or more or less comprehensive library-assisted drug screening, use of accurate mass measurement for universal screening to validated multi-analyte quantification of drugs, poisons and their metabolites (for details: Maurer HH (2007) Current role of liquid chromatography-mass spectrometry in clinical and forensic toxicology [review]. Anal.Bioanal.Chem. 388:1315).

Prof. Dr. Franco Tagliaro, Forensic Medicine, University of Verona, started his presentation on the current role of CE-MS in clinical and forensic toxicology with the provocative question, whether there is any need for CE-MS in these fields. After a short introduction about the advantages and disadvantages, he gave an interesting overview on application such as qualitative and quantitative determination of therapeutic and abused drugs and their metabolites in body fluids and tissues, protein and peptide analysis correlated with intoxications and illnesses (biomarkers of pathology), and finally determination of metal complexes with proteins in biological fluids using CE-ICP-MS. (for details: F. Tagliaro and F. Bortolotti (2008). Electrophoresis, 29, 260; F. Tagliaro, F. Bortolotti, J.P. Pascali. (2007). Anal. Bioanal. Chem., 388, 1359).

After the coffee break, Prof. Dr. Peter Hemmersbach, Antidoping Control Laboratory, Aker University Hospital and School of Pharmacy, University of Oslo, started with an overview on the development of doping control over years and the past and current role of GC-MS in this field. Although for many drug classes LC-MS can also be used, GC-MS is still the preferred method for steroid analysis. For detection of very low concentrations, high resolution or tandem mass spectrometers are combined with GC. Hemmersbach also explained that GC can be combined with a combustion unit and an isotope-ratio mass spectrometer (GC-C-IRMS) for determining the 12C/13C isotope ratio in order to prove an exogenous source for anabolic androgenic steroids. He concluded his talk stating that the unbeatable separation and identification power is the reason why GC-MS has a future besides LC-MS providing the necessary information for compound identification (for details: Hatton CK (2007), Beyond sports-doping headlines: the science of laboratory tests for performance-enhancing drugs. Pediatr Clin North Am. 54:713).

Prof. Dr. Mario Thevis, Center for Preventive Doping Research, Institute of Biochemistry, German Sport University, Cologne, introduced as the youngest speaker who crow up with LC-MS gave an excellent overview on the current role of LC-MS in doping control. He discussed that numerous assays formerly based on GC-MS have been transferred to LC-MS(/MS) due to reduced sample preparation efforts, better sensitivities and new options for the mass spectrometric identification of non-volatile compounds such as peptides and proteins. He demonstrated the advantages and disadvantages of LC, soft ionization and tandem MS for the detection of synthetic insulins, peptide hormones and artificial oxygen carriers as well as low molecular weight drugs such as designer steroids, selective androgen receptor modulators/SARMs, or stimulants. He concluded that the use of LC-MS/MS allows closing analytical gaps in the doping control field such as detection of peptide hormones (for details:

Thevis M, Schanzer W (2007) Current role of LC-MS in doping control [review]. Anal.Bioanal.Chem. 388:1351).

Prof. Dr. Jordi Segura, Antidoping Control Laboratory, BioAnalysis Research Group, Universitat Pompeu Fabra, Barcelona, completed the list of excellent presentations. He introduced the audience to the field of proteomics and metabolomics needed for doping control of e.g. recombinant products, blood masking agents, gene doping, etc. He showed the potential in obtaining structural information on increasingly important doping agents such as erythropoietin (EPO), growth hormone (GH), chorionic gonadotropin, hydroxyethyl starch and others. Segura concluded at the end, that although the present regulation by sport authorities do not yet require demonstration of the identity of protein doping agents by mass spectrometry, it is anticipated that the issue will shortly change when the increasing potential of mass spectrometry will be further developed (for details: Segura,J.; Pascual,J.A.; Gutierrez-Gallego,R. (2007) Procedures for monitoring recombinant erythropoietin and analogues in doping control [review]. Anal.Bioanal.Chem. 388:1521).

After three hours of an exciting symposium, chairman Maurer thanked the speakers and the audience and closed the session inviting everybody to the next IATDMCT congress 2009 in Montreal, the GTFCh-TIAFT congress 2010 in Bonn and of course to the next Analytica Conference 2010.

This symposium was accredited by the GTFCh with four credit points for members who are already certified Forensic Toxicologists GTFCh, Forensic Chemists GTFCh or Clinical Toxicologists GTFCh.