Editorial

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Only seven years after the 2014 CHIMIA special issue 68/3 'Mass Spectrometry in Switzerland' (guest editors: Detlef Günther and Gérard Hopfgartner) it was decided to publish another special issue of CHIMIA entitled '***Mass Spectrometry at Swiss Academic and Industrial Institutions***'. The decision to cover the same topic again within a relatively short period of time may be surprising, but illustrates how important the contribution of mass spectrometry in many fields of academic research is, including chemistry, biology, cosmochemistry, pharmaceutical and biomedical sciences, earth and environmental sciences, materials science and technology development, forensics and art restoration. Mass spectrometry is equally widespread in industrial research and development as well as quality control, in particular in companies that are active in diagnosis, in the pharmaceutical sector, the biomedical area, and in flavors & fragrances. The compilation of contributions from specialists in many of these fields shows how the breadth of applications as well as the analytical and instrumental toolbox are constantly and rapidly developing.

Mass spectrometric analysis may be carried out on solid, gaseous or – most frequently – liquid samples; they are typically body fluids, environmental samples, and solutions that have undergone separation for certain compounds or elements by chromatographic methods. On-line coupling of HPLC with MS is nowadays a standard method and widely applied (contributions by *Varela & Schmidt*; *Nanni et al*.; *Fornelli et al*.; *Muggli et al.*). Less widespread but equally interesting are electrophoretic separations (*Tobolkina et al*.). Liquid separation can also be achieved by ion exchange on resin beds (*Greber & Van Zuilen*) but may also require direct linking ('hyphenation') of an ICP-MS instrument with other devices, fractionating the sample according to size/molecular mass and physico-chemical speciation, for example *via* Asymmetric Flow Field-Flow Fractionation (AF4; *Worms & Slaveykova*). GC-MS, GCxGC-MS and direct mass spectrometric analysis, injection of volatiles are used in more specialized settings, for example the analysis of flavors and fragrances (*Begnaud*) or of exhaled metabolites (*Zeng et al*.).

Yet another set of tools is key for analyzing large biomolecules, including proteins, antibodies, and nucleic acids. Interesting new dissociation methods are being deployed for this (*Varela & Schmidt*; *Fornelli et al*.) that often even allow quantification (*Nanni et al*.; *Varela & Schmidt*). Special temperature-controlled ESI spray sources and high-mass detectors for MALDI are contributing to understanding the architecture and binding properties of large, noncovalent complexes of biomolecules (*Zenobi*).

The contributions in this issue also highlight the diversity of the analytical equipment used for optimal mass resolution or to maximize sensitivity. Different types of mass analyzers are used for mass/charge separation, such as magnetic and electrostatic sectors (*Worms & Slaveykova*, *Greber & van Zuilen*, *Wieler*), quadrupoles, FT-MS instruments including orbitraps (*Fornelli et al*.; *Jones & Janssen*; *Nanni et al*.; *Tobolkina et al*.; *Zeng et al*.), time-of-flight instruments (*Gasc & Hofer*; *Hutterli et al*.; *Zenobi*), or accelerators (*Synal*). According to the nature of the analyte, different ways of ionization are employed, including an argon plasma (*Worms & Slaveykova*; *Greber & van Zuilen*), electron impact ionization (*Wieler*; *Begnaud*), APCI (*Begnaud*), soft ionization such as electrospray (*Tobolkina et al*.; *Nanni et al*.; *Varela & Schmidt*; *Zenobi*; *Muggli et al*.; *Fornelli et al*.; *Jones & Janssen*) and MALDI (*Zenobi*), and specialized sources such as SESI or plasma-based ionization for volatiles (*Zeng et al*.). An entirely different field of applications is represented by *in situ* analysis of solid samples using ion sputtering for Secondary Ion Mass Spectrometry (SIMS; *Marin-Carbonne et al*.) or laser ablation for ICP-MS (*Greber & van Zuilen*). Analyzed materials may be minerals such as silicates, carbonates, sulfides and oxides; natural (volcanic) or manufactured glasses, semiconductor or photovoltaic materials, surface coatings, biological tissues, cosmic dust. Highly sophisticated equipment is needed for optimal sensitivity and mass resolution, as TOF-SIMS, large-radius SIMS or nano-SIMS, or multicollector-ICP-MS coupled to a nanosecond or femtosecond laser.

We also recognize that the Swiss mass spectrometry community is at the forefront of new instrument development, at companies like TOFWERK Thun (*Hutterli et al*.) and Spacetek (*Gasc & Hofer*), but also at ETHZ (*Synal*). This is an aspect that was not covered in the 2014 CHIMIA volume, which is also the reason that this special issue is larger than the one in 2014.

Last but not least: the sixteen contributions in this volume highlight not only the importance of mass spectrometry in the Swiss research landscape, but also demonstrate that exciting novel applications and developments are underway in many of the laboratories that are actively involved in mass spectrometry research.

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The Editorial Board of CHIMIA thanks guest editors Prof. R. Zenobi and Prof. U. Schaltegger for organizing this special issue on Mass Spectrometry at Swiss Academic and Industrial Institutions, providing an excellent overview of the wide-ranging and diverse applications for Mass Spectrometry and demonstrating that Swiss research is at the cutting edge in this field.

Front cover: Thermal ionisation mass spectrometer at University of Geneva (Department of Earth Sciences) used for precise isotope ratio measurement of elements (such as U, Pb, Sr, Nd…) isolated on ion-exchange resin beds. Multi-collector setup with motorised Faraday cups and a Daly-photomultiplier system in the foreground, magnet sector in gray behind, sample chamber to the left in the background. Equipment from IsotopX Ltd. (UK).