Editorial

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Members of the SCS Division Analytical Sciences (DAS) board

How can we improve the mass spectrometric identification of molecules in very complex mixtures by introducing another dimension of information? How can we use biological nanopores in molecular sensing or sequencing? Which handheld instrument can solve such diverse problems as detection of tumours during surgery, gemstone falsification, or illicit drugs or explosives? How can we elucidate the role of water in a catalytic oxidation reaction? How can we improve the resolution of mass spectrometers? How can we develop a laser-based instrument to detect organic matter on solar system objects? How can we use browsers for scientific data analysis?

Answering such diverse questions is part of analytical sciences. Among others, they will be presented in this issue. Today, scientific research is intimately connected to measurement science. Progress in the development of techniques to identify, quantify, visualize, image, and track chemical and biological compounds and processes in space and time are a central pillar to our understanding of the world. Indeed, enormous advances in molecular and atomic spectroscopy, separation science, electrochemistry and microscopy have given us a plethora of tools that are used to advance science in all disciplines. About 20% of graduated chemists work world-wide in the field of analytical chemistry[1,2] and we all use analytical chemistry.

Switzerland has rich history in the analytical sciences with many ground-breaking advances made by researchers who do not necessarily hold the title of an analytical chemist or saw themselves as one. They were interested in a particular problem and realized that the available analytical tools were missing. Knowing the problem while deeply understanding fundamental principles formed a powerful basis to advance the analytical sciences.

Indeed, Switzerland has been instrumental to the development of gas chromatography, blood gas electrolyte clinical analysers, lab on a chip, mass spectrometry techniques, NMR including structural NMR, EPR, but also imaging techniques including STM, AFM and Cryo-EM, to name a few.

The enormous importance of analytical science in all research and regulatory activities cannot be overstated. We should remember, however, that there are two sides of analytical science, the applied and the fundamental side.[3] Both are very important, and both work together. The applied side is what people often perceive, which is using established tools to provide analytical answers in any specific discipline. This activity includes method development to optimize any given protocol to a new problem. On the other hand, the fundamental side of analytical science may appear closer to physical chemistry, surface science, mathematics, or other fundamental disciplines. The difference is that the fundamental research targets the advancement of analytical science. This is how, historically, a solid theoretical foundation was developed to most routine techniques in use today. This knowledge, in turn, helps to conceive and develop novel principles and techniques that will benefit the applied side. Of course, the applied side inspires and guides the fundamental side.

Today, the fundamental side of analytical science is most often practiced in departments that focus and support basic research, especially University Chemistry Departments. The continuity of academic research for the fundamental side of analytical science is crucial to continue forming critical minds that will make important advancements.

The applied side is practiced by almost everybody, including academia, government entities and industry. With the availability of automated instruments many analyses can be carried out by trained personnel. However, basic analytical training is necessary to critically assess the results. This requirement is especially important with the advent of AI tools. Without sound knowledge of the basic principles of the full range of analytical techniques, as well as statistics/chemometry, there is a high risk of incorrect interpretation. Universities must not neglect these topics in the curricula.[4]

A fruitful relationship between the two sides is very important for the advancement of analytical science. In Switzerland, this role is assumed by the *Division of Analytical Science* (DAS) of the Swiss Chemical Society. It is the principal forum in which actors of the two sides of analytical science come together. DAS organizes a yearly meeting, *CH*analysis, to bring the main actors together to network and exchange ideas. DAS is also the main organizer of many other conferences in the analytical sciences, including HPLC, IMSC, Euroanalysis, ILMAC and many others. It has also developed and maintained a robust continuing education program in the analytical sciences provided in the SCS Academy offerings (https://www.academy.scg.ch).

This special issue aims to showcase the diversity of analytical sciences in Switzerland. Many readers of *CHIMIA* are already familiar with the Analytical Highlights coordinated by Veronika Meyer. These are one-page short descriptions of advances in the analytical sciences (both fundamental and applied sides) that have appeared in most issues for many years. We encourage our readers to contribute a highlight by contacting analytical_highlights@chimia.ch.

[1] R. Salzer, N. Hrastelj, A. Smith, *Chem. Eur. J*. **2024**, *30*, 1, https://doi.org/10.1002/chem.202401222.
[2] E. Kováts, P. R. Radvila, B. Schreiber, *CHIMIA*, **1999**, *53*, 281, https://doi.org/10.2533/chimia.1999.281.
[3] G. M. Hieftje, *Anal. Chem*. **1985**, *57*, 256 A, https://doi.org/10.1021/ac50001a006.
[4] https://iupac.org/project/2019-039-3-500

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