Editorial

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Photos: Giulia Marthaler/ ETH Zürich

Research in magnetic resonance has played an important role in Switzerland since the very early days due to the pioneering work of Prof. Hans Primas at ETH Zürich and other researchers in Switzerland in the 1960s. A good indication of the importance of Swiss contributions to NMR research are the two Nobel prizes awarded to Prof. Richard R. Ernst in 1991 "for his contributions to the development of the methodology of high-resolution nuclear magnetic resonance (NMR) spectroscopy" and to Prof. Kurt Wüthrich in 2002 "for his development of nuclear magnetic resonance spectroscopy for determining the three-dimensional structure of biological macromolecules in solution".

Today, more than 30 research groups at Swiss universities and in industry work on different aspects of magnetic-resonance research covering electron-paramagnetic resonance (EPR) spectroscopy, magnetic resonance imaging (MRI) and *in vivo* spectroscopy, and nuclear magnetic resonance (NMR) spectroscopy. The research topics of the various groups cover a wide range from fundamental topics like new detection schemes for magnetic resonance phenomena and hardware-related research, to groups that work on theoretical aspects of describing and understanding NMR experiments, to pulse method development. There are also a large number of groups that work on applications in different fields where NMR methods are central for obtaining new insights into materials, biological systems, and medical questions.

This wide range in research topics is also reflected in the articles collected in this special issue of CHIMIA entitled 'NMR Spectroscopy in Switzerland'. In the first article by ***Aurélien Bornet*** and coworkers from the group of Geoffrey Bodenhausen at the Department of Chemistry at EPFL, current developments in Dynamic Nuclear Polarization (DNP) are described. DNP is an old method to increase the sensitivity of NMR spectroscopy by using electron polarization, which has recently become a hot topic in NMR research in the form of dissolution DNP in metabolic imaging and in the form of MAS DNP in solid-state NMR. Protein RNA and protein carbohydrate interactions investigated using solution-state NMR is the topic of the article by ***Antoine Cléry*** *et al*. from the group of Frédéric Allain at the Department of Biology at ETH Zürich. They discuss methods to study these complexes by NMR and how such data can be combined with X-ray structural data. The application of metabonomic studies to apple tissue is described in an article by ***Martina Vermathen*** and coworkers from the Department of Chemistry and Biochemistry at the University of Bern. They use high-resolution MAS NMR to directly characterize the apple tissue in order to distinguish different cultivation methods. Using HRMAS they can avoid changes in the composition incurred by pressing the apples and investigating the apple juice. ***Matthew P. Conley*** and ***Christophe Copéret*** at the Department of Chemistry at ETH Zürich describe the use of solid-state NMR to study surfaces. Such experiments have recently become a lot more accessible through the use of DNP to enhance the sensitivity of surface NMR. At the same time, the use of DNP increases the selectivity for the surface spins and suppresses signals from the bulk of the material. The study of membrane proteins and chaperons using solution-state NMR is discussed by ***Björn M. Burmann*** and ***Sebastian Hiller*** at the Biozentrum of the University of Basel. They discuss the techniques required to produce such samples in order to obtain high-resolution spectra. The article by ***Axelle Cotte*** *et al.* from the group of Damien Jeannerat from the Department of Organic Chemistry at the University of Geneva discusses methodological developments combining broad-band homonuclear decoupling in the indirect dimension and spectral aliasing to obtain high-resolution spectra without excessively long acquisition times.

Barbara Krähenbühl and ***Gerhard Wider*** at the Department of Biology at ETH Zürich describes the use of high-dimensional spectra for increased spectral resolution of large molecules. To avoid overly long measurement times the multi-dimensional spectra are not measured directly but reconstructed from lower-dimensional projection spectra. This method has been dubbed Automated Projection Spectroscopy (APSY). The analysis of ruthenium complexes by solution-state NMR is described by ***Federico Giannini*** *et al.* from the group of Julien Furrer at the Department of Chemistry and Biochemistry at the University of Bern. They analyze inorganic ruthenium complexes that can potentially be used a cancer drugs. ***Reto Walser*** and ***Oliver Zerbe*** at the Institute of Organic Chemistry at the University of Zürich describe their efforts towards a solution-state NMR structure of a G-protein coupled receptor using fragments of the full protein. A new approach to the simultaneous characterization of structure and dynamics of proteins is presented by ***Beat Vögeli*** and coworkers from the group of Roland Riek at the Department of Chemistry at ETH Zürich. They use exact NOE rates to determine ensemble-averaged distance restraints that lead to an ensemble of structures that contains information about the structure as well as the dynamics of the molecule. The contribution by ***Daniela Donghi*** *et al.* from the groups of Roland Sigel and Eva Freisinger from the Institute of Inorganic Chemistry at the University of Zürich describes their efforts to apply solution-state NMR to problems in bioinorganic chemistry and in particular to understand the binding of metal ions to RNA. Finally, ***Giorgia Zandomeneghi*** *et al.* from the group of Beat H. Meier at the Department of Chemistry at ETH Zürich and from Bruker Biospin report about the current possibilities of biological solid-state

NMR developments expected in the near future. Part of this future is the foundation and opening of the 'Richard R. Ernst Magnetic Resonance Facility' at ETH Zürich which will house the first 1.1 GHz wide-bore NMR spectrometer for solid-state NMR. It is expected that the increase in field strength from 850 MHz to 1.1 GHz will provide new opportunities for investigating structure and dynamics of significantly larger molecules than are accessible today.

Overall, the topics covered in this special issue demonstrate the breadth of NMR research in Switzerland ranging from theoretical development to methodological development to applications. It shows that NMR has become a very mature technique that can contribute to many areas of chemistry and material sciences. At the same time, the very active development of new techniques continues to make NMR an even more versatile technique and there is no end in sight to this exciting development.

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It is with great pleasure that the Editorial Board of CHIMIA warmly thanks Prof. Dr. Matthias Ernst and Prof. Dr. Roland Riek for their efforts in the planning and successful realization of this issue on 'NMR Spectroscopy in Switzerland', which provides an in-depth insight into a fascinating and important technique.