Editorial

Science with radioactive elements and with radioisotopes of stable chemical elements, generally referred to as *radiochemistry,* is a multidisciplinary field, the benefits of which are often not immediately obvious. Although not (anymore) a field of its own as it used to be in the first half of the twentieth century, knowledge about the numerous opportunities related to the instabilities of nuclei contributes to both fundamental and applied sciences. The phenomena of radioactivity, a central issue of radiochemistry, does not have an impressive reputation in the public eye and that is why its perceptions are hardly recognized, probably with the exception of the synthesis of new members of the periodic table, the super heavy elements. Research and applications with radioisotopes reaches out to essentially all fields of science, including chemistry, physics, biology, medicine, environmental and material sciences and many others.

Radiochemistry goes thus far beyond what is often considered as its main purpose, namely research in the context of nuclear energy or nuclear waste disposal. This diverse role is often not recognized by the public and even researchers in other scientific fields are not aware of its potential. This issue thus aims at revealing in more detail the fields in which radiochemistry and radioactivity are inherently important, both in basic and in applied sciences.

Radioisotopes are core in nuclear medicine and radiopharmacy, for the non-invasive detection of dysfunctions and diseases. Specially designed pharmaceuticals, carrying distinct radioisotopes, allow for the non-invasive and quantitative imaging of *e.g.* overexpressed receptors on cancer cells. This enables personalized, individual treatment. Metabolite studies of radiolabeled molecules are essential for drug development in the pharmaceutical industry. The basis for discovering such molecules, synthetic and analytical chemistry with radioisotopes, is indispensable. Experiments at large accelerators to synthesize super heavy elements extend our knowledge about the configuration of the electron shells, confirm physical theories and assess the systematics behind the periodic table. Radioisotopes are central in environmental sciences, in age determinations and geological dynamics. The analytics of non-natural radioisotopes released in the environment contributes to safe processes as well as to the remote detection of incidents.

Finally, yet importantly, radiochemistry is also of commercial interest as mirrored by the contribution of a company with a long-standing tradition and experience in this field. Besides the research aspects described in this volume, advanced and profound expert education in radiochemistry is crucial for Switzerland and for persistently keeping the field alive. This issue therefore serves also to reveal the attractiveness of radiochemistry to young researchers and make them aware of the numerous possibilities radiochemistry still has to offer as an interdisciplinary field. The future will need experts to cover actual demands for high-quality research, but also for the private sector.

In addition to this special CHIMIA issue, the Swiss Academy of Science (SCNAT) recognized the central role of radiochemistry for Switzerland. It has issued a 'Weissbuch' on radiochemistry this year (R. Alberto, M. Burger, H. Gäggeler, Weissbuch Radiochemie Schweiz, Swiss Academies Reports 15 (4), 2020, doi:10.5281/zenodo.4147524), more general in nature and focusing on political and economic aspects of radiochemistry in Switzerland. Dive into the multiple facets of radiochemistry and enjoy reading the articles while learning more about its opportunities.

Roger Alberto
University of Zurich

Heinz W. Gäggeler
Paul Scherrer Institute

The Editorial Board of CHIMIA thanks the guest editors Prof. Dr. Roger Alberto and Prof. Dr. Heinz W. Gäggeler for putting together this very interesting set of articles demonstrating the many wide-ranging aspects of radiochemical research in Switzerland. We would also like to thank Prof. Jason Holland, University of Zurich, for designing the picture on the front cover of this issue.