# Young Career Focus: Professor Vittorio Pace (University of Vienna, Austria)

**Background and Purpose.** SYNFORM regularly meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Professor Vittorio Pace (University of Vienna, Austria).

## Biographical Sketch

*Prof. V. Pace*

**Vittorio Pace** obtained a degree in Pharmacy from the University of Perugia (Italy) in 2005. He then undertook PhD studies (2006–2010) at the Complutense University of Madrid (Spain) under the guidance of Professors A. R. Alcántara and J. V. Sinisterra. He realized placements at the Universities of Ghent (Belgium, Professor N. De Kimpe), Trieste (Italy, Professor L. Gardossi) and Graz (Austria, Professor W. Kroutil). In 2009, he also obtained a postgraduate MSc in Drug Design and Development from the University of Pavia (Italy). In 2010, he moved to the University of Vienna (Austria) to join the group of Professor W. Holzer as a Mach postdoctoral fellow. Postdoctoral training continued with Professor D. J. Procter at The University of Manchester (UK, 2011–2013) and with Professor B. Olofsson at Stockholm University (Sweden, 2013–2014). In August 2014, he came back to Vienna as a group leader in Synthetic Chemistry at the Department of Pharmaceutical Chemistry. In November 2014, he obtained a habilitation for Associate Professor of Organic Chemistry by the Italian Ministry of Education. In 2015, he was awarded with the Vincenzo Caglioti Prize by the Accademia Nazionale dei Lincei, the Ciamician Medal by the Division of Organic Chemistry of the Italian Chemical Society and the Young Investigator Award by the Faculty of Life Sciences of the University of Vienna. In May 2016, he submitted his Habilitation Thesis for the *venia docendi* at the University of Vienna. His main research interest deals with the application of lithium carbenoids and organometallic reagents in organic synthesis.

## INTERVIEW

**SYNFORM** *What is the focus of your current research activity?*

**Prof. V. Pace** My group is working on the development of novel synthetic strategies based on the use of particular functionalized reagents, as metal (mainly lithium and magnesium) carbenoids are. In particular, we look at performing homologation-type reactions which constitute highly versatile tools in synthetic medicinal chemistry. Strong attention is devoted to establishing reaction conditions able to exploit the nucleophilic behavior of such ambiphilic reagents with the aim of designing fully chemoselective processes. The systematic study of the reactivity of these reagents with electrophilic partners such as carbonyl derivatives allowed us to describe new protocols for formally inserting functionalized $C_1$-synthons. More recently, our interest encompassed the use of chiral organolithium reagents and hydride nucleophiles in analogous nucleophilic additions.

**SYNFORM** *When did you get interested in synthesis?*

**Prof. V. Pace** During my undergraduate studies in Pharmacy at the University of Perugia (Italy) I felt a particular interest towards organic synthesis, culminating in realizing my MSc thesis under the direction of Professor Curini and Dr. Rosati. Later on, I started my PhD at the Complutense University of Madrid with Professors Alcantara and Sinisterra on integrated approaches towards α-haloketones as prochiral precursors of biologically active structures. During my PhD I had the opportunity to visit the lab of Professor De Kimpe at Ghent University (Belgium) where I got to work with diazomethane-based homologations and therein I started to think about embarking on a postdoctoral experience on synthetic methods. Just after defending my PhD, I did postdoctoral training in Austria (with Professor Holzer), the UK (with Professor Procter) and Sweden

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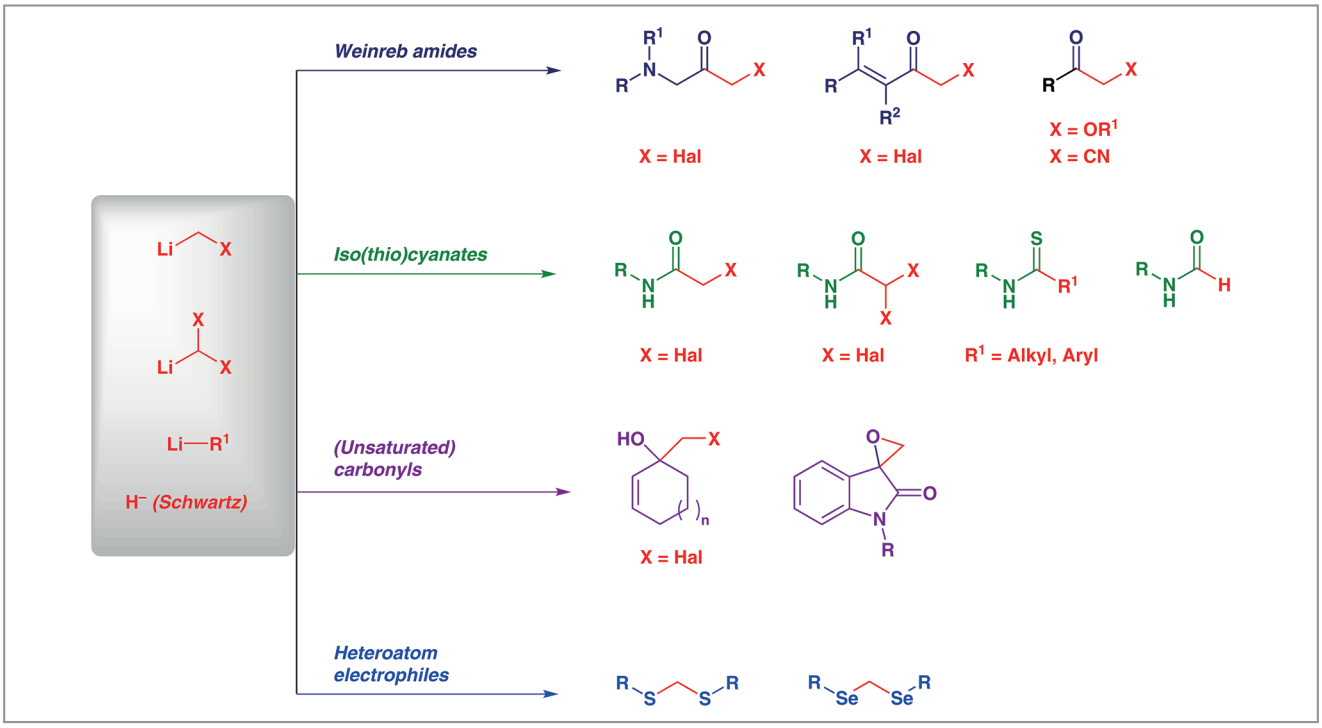
(with Professor Olofsson) and after four years I went back to the University of Vienna as a group leader in synthetic chemistry.

**SYNFORM** *What do you think about the modern role and prospects of organic synthesis?*

**Prof. V. Pace** Organic synthesis plays a pivotal role in modern chemistry and biology: there is almost no possibility of providing society with pharmacologically active substances without it. As such we should all be conscious of its fundamental importance in science. Nowadays, we have excellent tools for assembling complex molecules which, unfortunately, are often regarded as non-environmentally friendly despite their undoubtable efficiency: in my opinion, this concept should be demystified and redefined in the broad context of what synthetic chemistry is able to provide. Moreover, profound chemical education is required for generating a new class of chemists able to develop strategies based not only on recently reported techniques but also keeping an eye on old literature, which represents a precious source of inspiration. I hope to have fully demonstrated this concept in my Habilitation thesis entitled "*New Perspectives in Homologation Processes for Synthetic Medicinal Chemistry: Lithium Halocarbenoids at the Helm*" submitted at the University of Vienna in May 2016.

**SYNFORM** *Your research group is active in the area of organic synthesis, medicinal chemistry and drug design. Could you tell us more about your research and its aims?*

**Prof. V. Pace** My group has two main research lines strictly connected: 1) synthetic methodology and 2) synthetic medicinal chemistry. This last topic is conducted in collaboration with colleagues active in drug design and modeling operating in our department (Professors Langer and Ecker), who provide us with lead compounds to be synthesized. On the other hand, the development of synthetic methodology is very important for us since it allows us to establish and design protocols of general usefulness for the scientific community. The study of reaction mechanisms and the trapping of intermediates occupy a central place in our investigations. The deep understanding of a given process enables us to control and modulate the reactivity with the final aim of maximizing the chemical efficiency. In this context, I am grateful to our NMR specialists – Professors Holzer and Urban – for the admirable advice in elucidating mechanisms. Furthermore, we consider it highly significant and productive to apply our developed method-




**Scheme 1** Overview of homologation and related processes developed in Pace's group

ologies to the synthesis of important scaffolds (e.g. intermediates required in drug synthesis), or even to employ recently reported chemistry to one of our synthesized materials with the aim of exploiting both the synthetic potential and appeal. In conclusion, I believe our success depends both on the fruitful collaborations within the department, and the motivation and dedication my students put in their daily work. Thanks to Laura Castoldi, Serena Monticelli, Karen De la Vega, Marta Rui, Vanna Parisi, Azzurra Pelosi, Irene Murgia…*inter alia*.

**SYNFORM** *What is your most important scientific achievement to date and why?*

**Prof. V. Pace** Since we started some years ago, our research on the use of organolithium reagents has received good international visibility, as also demonstrated by highlights appearing in *Synfacts* or *Org. Process Res. Dev.* The reactivity of these reagents with heterocumulenes (isocyanates and isothiocyanates) is, in my opinion, our most impactful achievement since we have been able to form new functionalized C–C or C–H bonds through a single synthetic step. In such a way, (thio)amide derivatives could be assembled in very high yields and, in the case of using enantiopure reagents, in excellent enantiomeric ratios. Effectively, the reactivity of heterocumulenes towards organometallic reagents is so high because of the practically negligible electronic and steric effects played by the substituent at nitrogen. Remarkably, we smoothly prepared a wide library of thioamides in a conceptually different and more efficient approach to the classical ones based on thionation procedures, the drawbacks of which, such as harsh conditions or bad smells, are well known among chemists.