Young Career Focus: Dr. Mattia Silvi (University of Nottingham, UK)

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 Dr. Mattia Silvi (University of Nottingham, UK).

Biographical Sketch

Dr. M. Silvi

Mattia Silvi studied chemistry as undergraduate student at the University Sapienza (Rome, Italy). He then carried out his doctoral studies at the Institute of Chemical Research of Catalonia, ICIQ (Tarragona, Spain) under the supervision of Prof. Paolo Melchiorre, working in the fields of organocatalysis and photochemistry. He also spent part of his PhD at the University of Michigan (Ann Arbor, MI, USA) in the group of Prof. John P. Wolfe working in the field of transition-metal catalysis. After obtaining his PhD in 2015, he moved to the University of Bristol (UK) in the group of Prof. Varinder K. Aggarwal, as a Marie Skłodowska-Curie Individual Fellow, where he carried out research in the fields of boron chemistry, prostanoid synthesis and photochemistry. In 2019, he started his independent career at the University of Nottingham (UK) as a Nottingham Research Fellow. In 2022, he was promoted to tenured assistant professor at the University of Nottingham. Mattia is the recipient of a 2023 Thieme Chemistry Journals Award, a 2022 ERC Starting Grant, a 2020 EPSRC New Investigator Award, and was selected as 2020 outstanding reviewer for the RSC journal Chemical Science. His research interests lie within the fields of organic chemistry, photochemistry and asymmetric catalysis, and these same fields are the focus of his research group's interests.

INTERVIEW

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

Dr. M. Silvi Assembling molecules is a difficult task for scientists. In this regard, organic synthesis often represents a bottleneck in the long process that leads to scientific innovation. Our research focuses on defining new practical and sustainable pathways towards chemical synthesis, thereby extending the strict boundaries that limit chemists' imaginations for the invention of the molecules of tomorrow. We are currently exploring modern tools of organic chemistry, e.g., photoredox catalysis, to develop novel synthetic disconnections and cross-coupling strategies in synthesis.

SYNFORM *When did you get interested in synthesis?*

Dr. M. Silvi During my studies in chemistry, I initially thought I would be more inclined towards analytical chemistry, and I obtained my bachelor's degree in this subject. However, organic synthesis and organic chemistry had such a magnetic effect on me that they quickly steered me towards a different pathway. Indeed, I later obtained both my Master's degree and my PhD in organic chemistry, and since then I have enjoyed assembling organic molecules, solving synthetic puzzles and developing new methodologies. My growth was catalysed substantially by the stimulating research environments in which I carried out my PhD and post-doctoral studies. For this, I am very grateful to my PhD and post-doctoral advisors, Profs. Paolo Melchiorre and Varinder K. Aggarwal, who both inspired me and provided significant support in various steps of my career.

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

Dr. M. Silvi During the last few decades, scientists have developed a remarkable ability to construct organic molecules. The advent of cross-coupling technologies, asymmetric catalysis, and the development of modern tools to tame highly reactive species such as radicals or electronically excited molecules has revolutionised substantially the way we conceive synthetic routes. However, there are open challenges that still need to be addressed. We still heavily rely on the use of non-abundant precious metal catalysts and on reactions with poor atom economy. The advent of C–H functionalisation chemistry has partially tackled these issues, opening new avenues in late-stage functionalisation, but my impression is that much work is still needed to unravel the fundamentals of this chemistry and to control the selectivity in the complex systems that scientists typically face during their real-life applications.

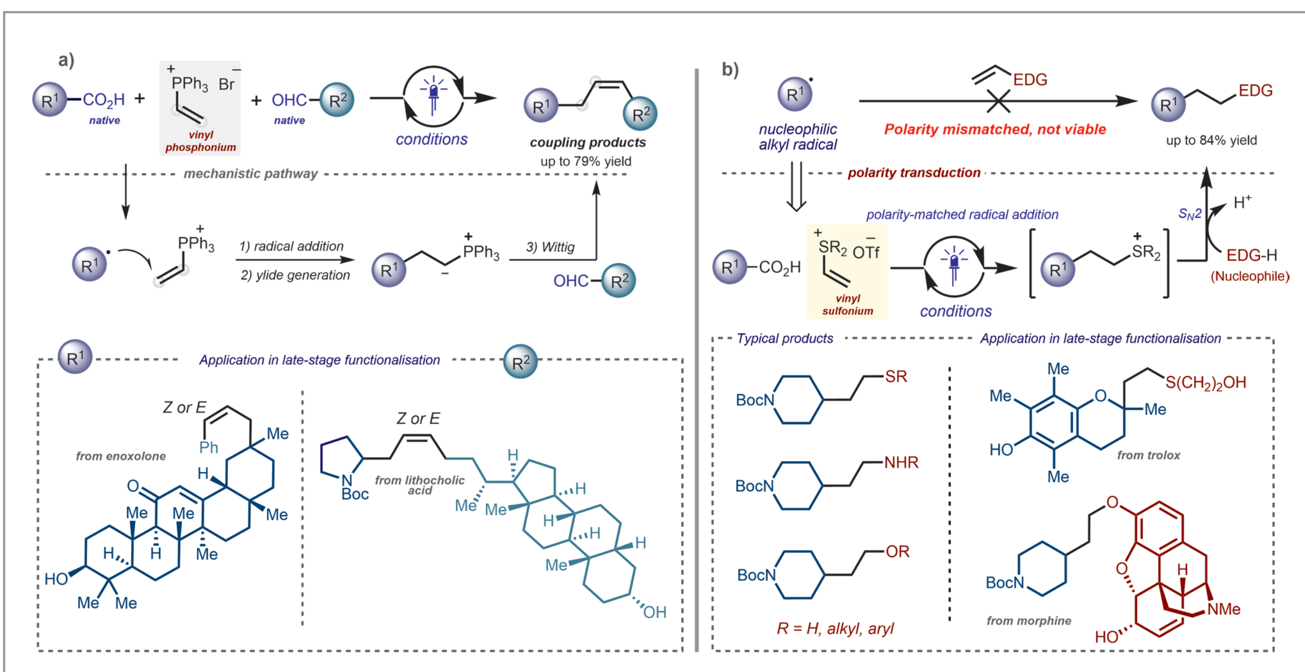
While these are still big challenges, this is a bright moment for organic chemistry. I can't wait to see new adventures in the arena!

SYNFORM *Could you tell us more about your group's areas of research and your aims?*

Dr. M. Silvi Currently, our research focuses on the development of novel synthetic methodologies that harness visible light to promote radical reactions. Our ambition is to provide chemists with processes that allow functionalisation of organic molecules in their native form, with high efficiency and selectivity. This means conceiving novel functional-group-tolerant transformations requiring no (or minimal) use of activating group and protecting strategies. We have exciting projects in the pipeline, and in the long term we believe that our research mission will contribute to providing scientists with more sustainable processes, as well as with a versatile synthetic platform for late-stage functionalisation.

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

Dr. M. Silvi Building upon my previous track record in organocatalysis,[1] and radical chemistry,[2] I have recently launched a new research programme in photoredox catalysis. This is a challenging research field for young academics due to the substantial competition with more established research groups. To differentiate our research from others in the area, we chose to investigate the reactivity of unconventional radical traps and harness their potential to address open challenges in organic synthesis.



Scheme 1 Unconventional radical traps explored by Dr. Silvi, and research methodologies developed

In this regard, we have recently introduced the use of vinyl phosphonium ions in photoredox catalysis, merging radical chemistry with the Wittig reaction (Scheme 1a).[3] The methodology provides an unconventional *conjunctive* coupling strategy for complex sp^3 molecular fragments, forging new C–C bonds using *exclusively native functionalities* in the partners. This was previously considered a challenge for more traditional cross-coupling chemistry and is expected to open new pathways in late-stage functionalisation.

We then introduced vinyl sulfonium ions as novel acceptors in radical conjugate addition chemistry, developing a synthetic strategy that we have termed *polarity transduction* (Scheme 1b).[4] This concept allowed the development of a formal polarity-mismatched radical addition to alkenes, addressing one of the major scope limitations of traditional radical methods.

I believe that having defined such a highly distinctive research line in the very popular field of photocatalysis represents my most significant scientific achievement as an early career researcher. I am grateful to the wide synthetic community for the continuous support and for recognising this achievement through prestigious prizes and awards, including an ERC Starting Grant, an EPSRC New Investigator Award, and a 2023 Thieme Chemistry Journals Award.

REFERENCES

(1) Selected examples: (a) M. Silvi, I. Chatterjee, Y. Liu, P. Melchiorre *Angew. Chem. Int. Ed.* **2013**, *52*, 10780–10783. (b) M. Silvi, E. Arceo, I. D. Jurberg, C. Cassani, P. Melchiorre *J. Am. Chem. Soc.* **2015**, *137*, 6120–6123. (c) M. Silvi, C. Verrier, Y. P. Rey, L. Buzzetti, P. Melchiorre *Nat. Chem.* **2017**, *9*, 868–873.

(2) Selected examples: (a) M. Silvi, C. Sandford, V. K. Aggarwal *J. Am. Chem. Soc.* **2017**, *139*, 5736–5739. (b) M. Silvi, R. Schrof, A. Noble, V. K. Aggarwal *Chem.–Eur. J.* **2018**, *24*, 4279–4282. (c) M. Silvi, V. K. Aggarwal *J. Am. Chem. Soc.* **2019**, *141*, 9511–9515. See also references 1b and 1c.

(3) (a) D. Filippini, M. Silvi *Nat. Chem.* **2022**, *14*, 66–70. (b) D. Filippini, M. Silvi *Synlett* **2022**, *33*, 1011–1016.

(4) S. Paul, D. Filippini, M. Silvi *J. Am. Chem. Soc.* **2023**, *145*, 2773–2778.

