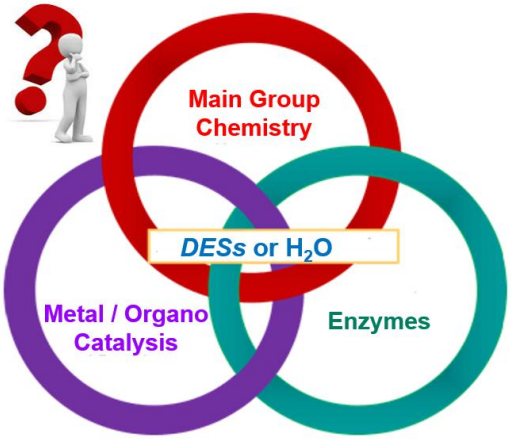
Aerobic- and Protic-Compatible Main-Group Chemistry: Bridging Polar Organometallic Reactivity with Metal-, Organo- and Biocatalysis

Polar organometallic compounds of the *s*-block elements are traditionally associated with rigorously anhydrous and oxygen-free conditions,[1] which has long limited their compatibility with other catalytic platforms. However, our research group and others have demonstrated that the use of unconventional reaction media [including *Deep Eutectic Solvents* (*DESs*) or water] enables highly reactive RLi/RMgX reagents to operate efficiently under aerobic and protic conditions.[2] Beyond improving operational simplicity and sustainability, these reaction environments profoundly reshape the reactivity of polar organometallic species, creating new opportunities for reaction design.

This lecture series will first present our recent advances in developing main-group chemistry under aerobic and protic conditions, highlighting how unconventional reaction media enable highly polar organometallic reagents to operate efficiently under bench conditions.[3] Building on these foundations, the lectures will demonstrate how these reaction environments enable the integration of polar organometallic reagents with transition-metal catalysis, organocatalysis and biocatalysis. Selected examples will illustrate the development of hybrid tandem one-pot processes that combine complementary synthetic tools, providing practical, efficient and sustainable strategies for molecular construction. Collectively, these studies demonstrate that aerobic and protic main-group chemistry represents not merely a more convenient way to perform classical organometallic transformations, but a powerful platform for the development of new multicatalytic synthetic methodologies.



[1] a) *The Chemistry of Organomagnesium Compounds* (Eds.: Z. Rappoport, I. Marek). Patai Series,Wiley, Chichester, UK, **2008**; b) J. Clayden, *Organolithiums: Selectivity for Synthesis*. Pergamon, Elsevier Science Ltd., Oxford, UK, **2002**.
[2] a) J. García-Álvarez, E. Hevia, V. Capriati, *Chem. Eur. J*., **2018**, *24*, 14854; b) S. E. García-Garrido, A. Presa Soto, E. Hevia, J. García-Álvarez, *Eur. J. Inorg. Chem.*, **2021**, 3116; c) J. García-Álvarez, V. Capriati, *SynOpen*, **2026**, *10*, 12.
[3] For selected examples, see: a) C. Vidal, J. García-Álvarez, A. Hernán-Gómez, A. R. Kennedy, E. Hevia, *Angew. Chem. Int. Ed.*, **2014**, *53*, 5969; b) C. Vidal, J. García-Álvarez, A. Hernán-Gómez, A. R. Kennedy, E. Hevia, *Angew. Chem. Int. Ed.*, **2016**, *55*, 16145; c) B. Parra-Cadenas, I. Fernández, F. Carrillo-Hermosilla, J. García-Álvarez, D. Elorriaga, *Chem. Sci.*, **2024**, *15*, 5929.
[4] a) L. Cicco, M. J. Rodríguez-Álvarez, F. M. Perna, J. García-Álvarez, V. Capriati, *Green Chem*., **2017**, *19*, 3069; b) M. Ramos-Martín, R. Lecuna, L. Cicco, P. Vitale, V. Capriati, N. Ríos-Lombardía, J. González-Sabín, A. Presa Soto, J. García-Álvarez, *Chem. Commun.*, **2021**, *57*, 13534; c) N. Ríos-Lombardía, G. Morís-Menéndez, I. Lavandera, V. Gotor-Fernández, J. García-Álvarez, *Adv. Synth. Catal.*, **2024**, *366*, 3144.