Building Dynamic (Supra)Molecular Architectures from Pyrrole-Based Building Blocks

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Pyrrole is traditionally regarded as a fundamental building block of porphyrins and porphyrinoids. Yet, its unique structural and chemical properties extend far beyond this classical role, enabling the construction of a diverse range of (supra)molecular architectures with unusual structural, dynamic, and recognition properties. The intrinsic features of pyrrole-based building blocks can be exploited to access molecular systems that combine structural complexity with dynamic behaviour and confined environments, providing opportunities to explore new modes of molecular recognition, interaction, and motion.

During the talk, the construction of pyrrole-based systems will be presented, spanning a range of molecular architectures of increasing complexity. The presentation will begin with crownphyrins, macrocyclic ligands which combine structural features of porphyrins and crown ethers.[1] The discussion will then move towards pyrrole-containing molecular cages, which provide confined environments for the study and control of molecular interactions. Among these systems are cages exhibiting intriguing tautomerism, as well as architectures capable of promoting metallophilic interactions within their cavities. More recently developed cages will also be presented, demonstrating the ability to accommodate contact ion pairs within their cavities. The use of iminopyrroles as versatile building blocks for the construction of mechanically interlocked porphyrinoids will then be discussed.[2] In this context, their application in the synthesis of molecular links and knots will be presented, demonstrating how the introduction of iminopyrroles induced intrinsically dynamic behavior of the assemblies. Finally, a class of rotaxanes incorporating calix[4]phyrin units that display an unusual mode of molecular motion, termed “fluttering,” will be presented.[3]

References

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Presenter Biography

Bartosz Szyszko is an Associate Professor at the Faculty of Chemistry, University of Wrocław. He received his PhD in 2014 under the supervision of Prof. Lechosław Latos-Grażyński. In 2015, he completed a postdoctoral fellowship with Prof. Jonathan R. Nitschke at the University of Cambridge, where he investigated the construction of supramolecular capsules through subcomponent self-assembly. His research group focuses on mechanically interlocked molecules, self-assembly, and macrocyclic chemistry. He has co-authored approximately 45 scientific articles and received several national-level awards, including the National Science Centre Award in 2025 and the W. Kołos Award in 2022.