Engineering Aromatic Oligoamide Capsules: A Dual Role in Molecular Recognition and Catalysis

Yann Ferrand[a]

[a] *Université de Bordeaux, CNRS CBMN UMR 5248*
2, rue Escarpit 33600 Pessac, France
yann.ferrand@u-bordeaux.fr

Aromatic oligoamides represent a privileged class of synthetic scaffolds for the molecular recognition of chiral polar guests, including small organic acids and carbohydrates.[1-4] Their oligomeric architecture confers unparalleled modularity, enabling precise tuning of structural, dynamic, and host–guest properties through systematic monomer variation. Notably, helical foldamers with adjustable inner diameters can function as molecular capsules,[3] fully isolating encapsulated substrates from the external environment (Fig. 1, left). Here, we introduce a groundbreaking iterative evolution strategy to engineer artificial receptors of exceptional selectivity for monosaccharide recognition—a notoriously challenging target. This approach leverages the modularity of folded synthetic oligomers, integrated with molecular modeling and high-resolution structural characterization, to achieve high binding specificity.

Building on these advances, our recent efforts have focused on the rational design of capsule-shaped supramolecular catalysts. While foldamer-based catalysis is emerging as a vibrant research frontier, the exploitation of foldamer capsules as catalytic molecular flasks—harnessing their intrinsic recognition properties—remains unexplored. In this context, we demonstrate how the strategic functionalization of a foldamer capsule with basic aromatic moieties facilitates guest deprotonation,[6] thereby enabling catalytic decarboxylation reactions (Fig. 1, right). These findings not only expand the catalytic repertoire of foldamer systems but also underscore their potential as programmable, substrate-selective molecular flasks.

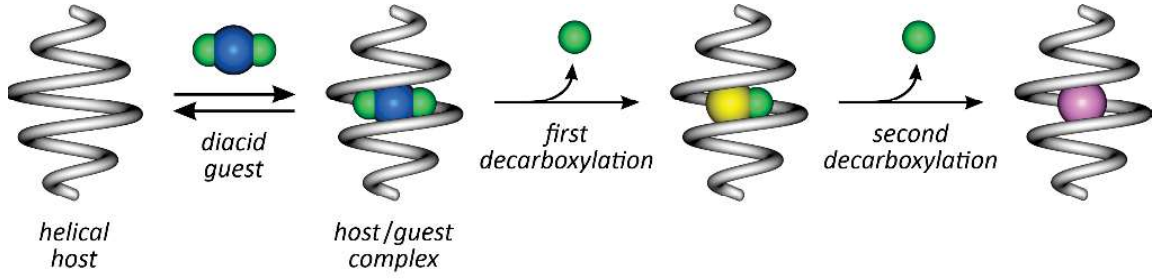

Figure 1. Schematic representation of a molecular recognition step within a helical capsule followed by two consecutive catalytic reactions on the same guest.

References

[1] Y. Ferrand et al, *J. Am. Chem. Soc.* **2010**, 132, 7858.
[2] N. Chandramouli et al, *Nat. Chem.* **2015**, 7, 334.
[3] Y.Ferrand, I. Huc, *Acc. Chem. Res.* **2018**, 51, 970.
[4] P. Mateus et al, *Angew. Chem. Int. Ed.* **2020**, 59, 5797.
[5] P. Mateus et al, *Chem. Sci.* **2021**, *12*, 3743.