**Supramolecular Lego with Cucurbiturils and Lanthanides**

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We will show first that a selection of alkali-, alkali-earth and lanthanide cations mediate the aggregation of Cucurbit[7]uril (CB[7]) complexes into well-defined trimers in solution, as long as (1) the solvent is dimethyl sulfoxide (and not water), and (2) the cavity of CB[7] is filled with a guest that leaves one carbonylated portal available for cation binding. In other terms, the CB[7]/guest trimer acts as a cryptand with exceptional affinity to the cations in dimethyl sulfoxide. We will then show that the binding selectivity of CB[n]s (n = 5 – 8), at least when guests are hydrocarbons or noble gases, can be predicted by mimicking the macrocycles with hard-sphere fluids with low polarities and low polarizabilities and “pre-formed” cavities. The importance of dispersive interactions in aqueous host-guest recognition will also be highlighted using a Cucurbituril-based supramolecular balance. We will conclude on a different note, with our latest advances towards the synthesis and manipulation of lanthanide-based assemblies on surfaces.

A diagram of a molecule

Description automatically generated

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