Adventures in Molecular Recognition: Dynamic Combinatorial Chemistry and Supramolecular Nanotubes

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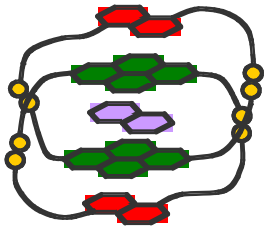
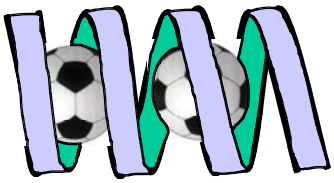
Classical organic synthesis, which relies on design and kinetically-controlled reactions, has a limited ability to create new kinds of molecules that are capable of molecular recognition. Therefore we have developed dynamic combinatorial chemistry, which is inspired by biological evolution and the mammalian immune system. We create complex equilibrating mixtures from which a template can gather around itself a successful host despite the complexity of the reaction mixture. This host can be selected, amplified, isolated and identified: we design the experiment, not the molecule. This provides the synthetic chemist with a selection approach to molecular recognition that complements the traditional design approach. It can change the way we think about synthesis, and provide us with a way of exploring how complex systems respond to external stimuli. We can even begin to do this in the solid state.





We will also discuss hydrogen-bonded nanotubes which we recently discovered: they self-assemble in solution from simple building blocks, and display rich host–guest chemistry, including the ability to dissolve C_{60} in organic solvents and to rearrange to give a different receptor in response to the presence of C_{70}.

Key References

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(4) Discovery of linear receptors for multiple dihydrogen phosphate ions using dynamic combinatorial chemistry: *J. Am. Chem. Soc.* **2011**, *133*, 3804.

(5) Helical supramolecular nanotubes: *Angew. Chem., Int. Ed.* **2007**, *46*, 194.

(6) Host–Guest chemistry of supramolecular nanotubes and related systems: a) *Angew. Chem., Int. Ed.* **2007**, *46*, 2338; b) *Org. Biomol. Chem.* **2010**, *8*, 4274; c) *Angew. Chem., Int. Ed.* **2011**, *50*, DOI: 10.1002/anie.201100806.