NOBEL SYMPOSIA

Report from the lecture presented by Julius Rebek

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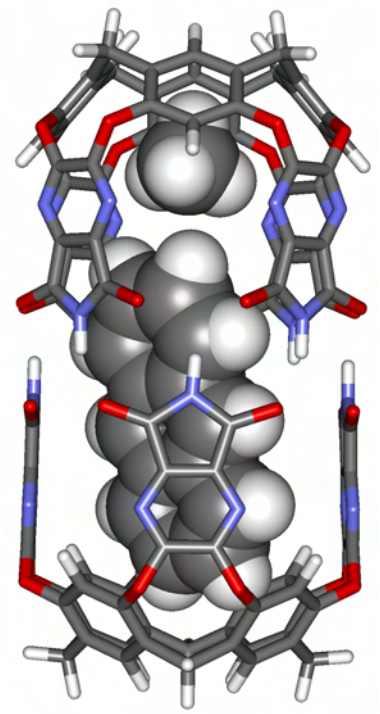
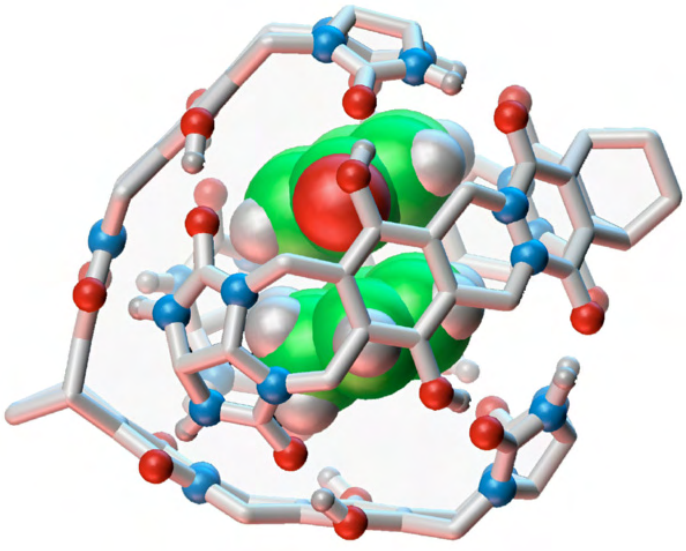
Although they are weak forces, hydrogen bonds are of fundamental importance for the structure, shape and function of bio-macromolecules, from the genetic code of the DNA double helix through its translation into function, via the folding of peptide chains into proteins. The reactions of Life take place in water (however, the lecture of Prof. Horwich on chaperones in this symposium presents other options), while many of the reactions of the synthetic chemist use a non-aqueous solvent.

Prof. Rebek's lecture showed how, in organic solvents, the molecular recognition from hydrogen bonding could be used to create precise structure and function by reversible *encapsulation*. The Figures below illustrate the concept: the two "half-capsules" (molecules in stick representation) bind by hydrogen bonds to each other and completely surround the guest molecules (in space-filling representation). A remarkable selectivity can be achieved by choosing solvent molecules that are too big and bulky to fit into the closed cavity: the capsule is formed only in the presence of guest molecules that can appropriately fill the "inner space".





For example, the cylindrical capsule on the left is formed only when both methane and anthracene are present as guest molecules simultaneously in the solution. By bringing selected molecules into a small space and keeping them close to each other, reversible encapsulation can reveal subtle intermolecular interactions and accelerate reactions. The capsule on the right does indeed accelerate the Diels-Alder reaction and by bringing the two reactants in exact position for reaction, the capsule mimics the active site of an enzyme.

For a recent review, see Rebek, J. *Simultaneous encapsulation: Molecules held at close range* Angewandte Chemie-International Edition 44 (14): 2068-2078 2005

The home page of the Rebek Laboratory: http://www.scripps.edu/skaggs/rebek/