Designed, Artificial Receptors and Chemosensors for Biomolecules

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Over the past 10 years, we have developed a unique approach to the designed complexation of organic molecules by hydrogen bonding. Fusion of heterocyclic and carbocyclic rings produces highly preorganized molecules in which hydrogen-bond donor and acceptor groups are oriented to a cleft or cavity. In spite of the relative rigidity of such "hexagonal lattice" receptors, complexation and guest exchange is rapid because the binding site is partially exposed to solvent. An advantage of this approach to fabrication of chemosensors is that reporter chromophores or fluorophores can be incorporated directly into the heterocyclic framework of the binding site. This insures direct communication between the binding and signal transduction events.

We have previously reported the application of this approach to a chromogenic reagent for creatinine (Science, 1995, 269, p.671), and to complexation of urea (Angew. Chem. Int. Ed. Engl., 1997, 36, p.1536) and guanidines (ibid., 1995, 34, 2163), even in competitive hydrogen-bonding solvents. This presentation deals with our current work on developing fluorosensors for blood metabolites, such as urea and creatinine, and on novel molecular probes for proteins and nucleotides. A highlight is the synthesis of a water-soluble artificial receptor for guanidinium cations that binds arginine, and particularly ArgArg, with high affinity in aqueous media.