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Pillararenes: Tubular-shaped artificial receptors. Cavitands Part 2

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Macrocycles are important supramolecular scaffolds for host-guest chemistry and offer a wide array of potential applications. This may range from design of synthetic catalysts, to the slow release of drug molecules, to the preparation of targeted sensors. Pillararenes have attracted considerable attention due to the large size of their cavity, and the fact that they are open at both ends, allowing them to bind large linear molecules such as DNA and proteins. Additionally, they can be modified with numerous functional groups allowing for tunable molecular recognition of a wide array of desired substrates. Synthesis of large pillararenes is challenging as they are entropically disfavoured. Pillar[5]arene is the mostly widely studied as it can be synthesized cheaply in high yields. For our purposes—binding single stranded DNA for the delivery of new types of biologics drugs—we require a larger cavity, such as pillar[7]arene or larger, to accommodate biological molecules (the number indicates the number of repeating subunits in the ring, larger numbers means a larger hole). We have designed and synthesized novel pillar[7]arenes which can be utilized as a binder for proteins and viruses, creating a supramolecular complex with two binding sites which has potential for dual-sensing or catalysis. Additionally, they may be combined with ferritin to create self-assembling biomolecular magnetic nanoparticles, or due to their large size, used to bind DNA. This presentation is an introduction to host-guest chemistry as it relates to pillarenes, and will discuss their synthesis and potential applications using examples from our lab.