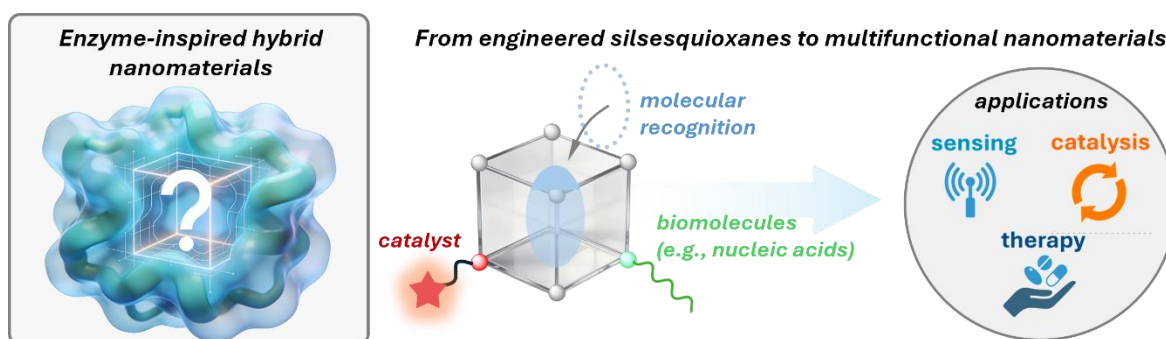


Nanomaterials have established a remarkable success story and now play central roles in areas ranging from catalysis to drug delivery and vaccine design.^{1,2,3} The next transformative step in the field will rely on multifunctional systems capable of performing coordinated tasks while approaching the structural and functional complexity of enzymes. Achieving this goal demands precision-chemistry strategies that deliver well-defined architectures with controlled functionality and intrinsic biocompatibility. In this context, cubic silsesquioxanes emerge as versatile molecular building blocks for enzyme-like nanomaterials, as their inorganic cores can be decorated with multiple, spatially defined functional groups. In combination with rational molecular design, these nanoscale cubes can display enzyme-mimetic behavior, offering a modular platform for next-generation nanomedicines that integrate sensing, catalysis, and therapeutic functions within a single scaffold. Herein, new synthetic routes to water-stable, multifunctional cubic silsesquioxanes are presented, alongside selected examples that illustrate their performance in catalytic, recognition-based, and stimulus-driven processes in biologically relevant environments. The capacity of these constructs to couple precise synthetic control with biomimetic functions, including controlled assembly/disassembly and anticancer activity, positions them as a promising class of advanced biomedical nanomaterials with potential impact on next-generation theranostics.



¹Pelaz, B. et al.; *ACS Nano*. **2017**, *11*, 2313–2381.

²Astruc, D.; *Chem. Rev.* **2020**, *120*, 461–463.

³Gupta, A. et al.; *Nat. Rev. Drug Discov.* **2024**, *23*, 914–938.