For about two centuries now, chemists have been developing and using various types of catalysts to facilitate organic reactions and thus to make desired target molecules more economically, more “cleanly,” and in shorter times. In recent decades, the spectrum of catalysts have been greatly augmented by the introduction of organometallic catalysts that can better differentiate between the substrates they can accept and process. Still, this so-called selectivity of man-made catalysts is not yet rivalling that of their biological counterparts – that is, the enzymes. Whereas man-made constructs typically recognize and preorganize the substrates by the few bonds in the immediate vicinity of the bond being made or broken, enzyme’s active sites present a complex patchwork of aminoacids that can recognize substrates based on their more distant features – accordingly, they can act with increased selectivity. In the proposed work, we wish to combine the powers of self-assembly and nanotechnology to make complex “artificial active sites” that literally build themselves from simple building blocks and, in this effortless way, can control the orientations of incoming substrates with the precision akin to real enzymes. The so-called nanozymes we will create will not only be extremely selective, but will also offer the durability characteristic of nanomaterials, and the flexibility of design characteristic of supramolecular systems. Using these unique constructs, we will be able to achieve synthetic transformations of molecules that were previously out of synthetic reach, ultimately facilitating discovery of new useful chemicals, including candidates for new drugs.