The use of metal-ligand bonding as a driving force for self-assembly reactions enables the construction of polynuclear architectures. Depending on the building blocks used, the resulting assemblies may be discrete molecules or extended frameworks. Over the past five years, the Cook Group has explored coordination-driven self-assembly with an emphasis on functional designs. By exploiting the presence of multiple metal centers and rigid organic building blocks, it is possible to design metal-organic architectures that are capable of catalysis, electrochemical energy storage, and separations chemistry. We have also studied the so-called emergent properties that result when two or more photoactive building blocks interact within a structure, to give photophysical properties that differ from the parent tectons. This talk will introduce fundamental aspects of coordination-driven self-assembly and then will highlight our advances in the areas of oxygen reduction electrocatalysis, hybrid polymer/inorganic materials, photoactive assemblies, and redox flow batteries.