DNA as a Versatile Biomolecular Scaffold for Asymmetric Catalysis

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DNA is one of the most plentiful and naturally ocurring helical polymers on Earth. Recently, this ubiquitous helical polymer has gathered attention as a chiral source for asymmetric synthesis. Since the pioneering study by Feringa in 2005, DNA hybrid catalysts have been applied to various key asymmetric carbon-carbon bond-forming reactions. Our group is exploring the potential of DNA for asymmetric catalysis. We have investigated DNA-based catalysis to answer a question as: How does DNA induce selectivity in chemical reactions? We have devised a systematic and modular strategy for the DNA hybrid catalyst based on the direct incorporation of a metal-binding ligand into the DNA strand and found the critical factors that govern catalytic properties of DNA hybrid catalysts. This took us a new insight into DNA metalloenzymes comprising a native DNA duplex and Cu(Ⅱ) ions. Now, my research team are working on the library of enzyme-mimic DNA hybrid catalysts and investigating their catalytic activity with various metal ions. In this talk, I will discuss our recent progress in the development and application of DNA hybrid catalysts for the asymmetric catalysis.