

Abstract:

The central dogma of molecular biology begins with DNA, which is the fundamental genetic material. This biomolecule has notable advantages towards the generation of supramolecular scaffolds, using programmable self-assembly. First, I will discuss how the properties of double-stranded DNA can be explored to create highly organized structures at nanoscopic levels. To generate such highly ordered structures, the use of branched DNAs provides great versatility. Branched DNAs (bDNA) can be generated through the self-assembly of smartly designed single stranded DNA (ssDNA) sequences.¹ Alternatively, bDNAs can be generated from synthetic branch points. We were interested in the development of bDNAs from synthetic branched monomers to study their self-assembly properties.² Second, I will focus on the recent advances made from the Silverman group to the field of DNA catalysis. In particular, we can compare the catalytic properties of RNA, DNA and DNA catalysts (known as deoxyribozymes) for DNA cleavage reactions. The discovery of catalytic ribonucleic acids (known as ribozymes) in living organisms revealed that nucleic acids have properties required to sustain catalysis.³ Although, nature has chosen double stranded DNA as genetic material, the chemical similarities between DNA and RNA implied that DNA might display catalytic properties as well. The first deoxyribozyme was discovered in 1994 through in vitro selection experiments; it catalyzed the cleavage of RNA molecules.⁴ Since then, several deoxyribozymes have been discovered for a variety of biochemical reactions.⁵ Recently the Silverman group contributed several deoxyribozymes. In particular, we have produced deoxyribozymes that can cleave DNA and also we compared catalytic properties of RNA and DNA for Diels-Alder reaction.⁶

BIO:

Dr. Madhavaiah Chandra received his M.Sc. degree in chemistry from the Sri Venkateswara University, Tirupati, India in 1998. He completed his Ph.D. degree in chemistry with Prof. Sandeep Verma at the Indian Institute of Technology, Kanpur in 2004. He was then an Alexander von Humboldt postdoctoral fellow with Prof. Andreas Marx at the University of Konstanz, Germany. Since November 2006 he has been a postdoc at the University of Illinois at Urbana-Champaign, working in Prof. Scott K. Silverman research group.