重庆大学药学院

天然产物全合成与创新药物研究重庆市重点实验室

学 术 报 告 第 二百三十八 讲

报告题目：The Simple Side of DNA Self-Assembly

报 告 人：Chengde Mao（毛诚德）教授（美国普渡大学化学系）

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报告人简介：

Education

1986 B.S., Peking University.

1999 Ph.D., New York University.

1999-2000 Postdoctoral Fellow, New York University.

2001-2002 Postdoctoral Fellow, Harvard University.

Positions

2002-2007 Assistant Professor, Purdue University, Department of Chemistry.

2007-2012 Associatet Professor, Purdue University, Department of Chemistry.

2012- Professor, Purdue University, Department of Chemistry.

Research Interest

I am interested in programmed self-assembly of nucleic acids (DNA and RNA), or DNA nanotechnology. Nucleic acids are information-rich molecules. They have well-defined secondary structures (duplexes) and simple interaction rules (Watson-Crick base pairing). These chemical properties render nucleic acids to be excellent molecules for programmed self-assembly. Since 1982, a wide range of nanostructures have been constructed and find applications in biosensing, imaging, smart drug delivery, organizing chemical reactions, plasmonic devices etc. Current

research topics in my group include:

1. DNA/RNA self-assembly. A key question that we would like to address is: how can we prepare complicated DNA nanostructures simply from minimal numbers of unique component DNA/RNA strands? In this regards, we are extensively taking advantage of structure/sequence symmetries.

2. Structural determination of biomacromolecules. The central idea is to organize biomacromolecules onto self-assembled DNA nanostructures to form highly symmetric biomacromolecule-DNA complexes, which can be readily characterized by X-ray crystallography or cryo-EM imaging.

3. DNA-directed guest self-assembly. DNA nanostructures can serve as a platform to organize/integrate multi-functionalities (such as molecular recognition, catalysis, and light harvesting).

3. DNA-based molecular lithography. We are developing methods to transfer DNA nanostructures into nanostructures of functional materials, e.g. silicone.

4. DNA nanomachines. Conformational changes of DNA can be programmed to perform particular functions, e.g. transporting materials along prescribed paths.

5. DNA-based nanomedicines. We are exploring using DNA nanostructures as platforms for sensitive disease diagnosis, bioimaging, and smart drug (small nucleic acid drugs in particular) delivery, and therapeutic devices.

6. Interrogation of basic biological processes/interactions related to spatial-temporal controls. Among many biological problems of our interest, multivalency is particularly important. It is a common strategy in biological events, ranging from immune responses to cell interactions. DNA nanostructures provide a universal tool to organize ligands for studying multivalent interactions.