

Mengxi Zheng

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EDUCATION

Purdue University	Aug. 2016 - July 2022
Ph. D. in Chemistry	
Nanjing University, P. R. China	Sept. 2012 - July 2016
B.S. in Chemistry	

HONORS & AWARDS

The Guy Mellon Award in Analytical Chemistry	2022
Henry Bohn Hass Memorial Fellowship	2019
Herbert C. Brown Lecture Award	2019
Xiexin Scholarship	2015
Innovation Achievements Scholarship	2015

RESEARCH EXPERIENCE

Postdoctoral Research Associate, the University of Illinois, Urbana-Champaign Aug. 2022- Present
Carl R. Woese Institute for Genomic Biology

Advisor **Prof. Xing Wang**

Advancing mRNA-Based Cancer Vaccines via DNA-RNA Hybrid Nanostructure

- Developed compact RNA-DNA hybrid nanostructures as vessels to enhance the delivery of mRNA into dendritic cells.
- Investigated the influence of nanostructure geometry on the delivery efficiency and expression outcome.
*This project has resulted in one manuscript **under preparation** (first author).*

Developing DNA Nanostructure-Enabled Home and Self-Tests for Virus Detection

- Integrated designer DNA nanostructures into lateral flow assay (LFA) devices to develop a high-efficiency virus (SARS-CoV-2 and HIV) home-test device.
*This project resulted in a publication in **Anal. Chem.** (second author) and a manuscript **under preparation**.*

Graduate Student, Purdue University Aug. 2016- July 2022

Department of Chemistry

Advisor **Prof. Chengde Mao**

Constructing Single-Stranded Folded DNA and RNA Nanostructures for Large-Scale Production

- Developed a programmable folding strategy to create DNA and RNA nanostructures.
- Achieved intracellular cloning and expression of RNA nanostructures, enabling large-scale production.
- Introduced a 15-minute heat-quench method to prepare single-stranded DNA nanostructures from DNA duplexes, resulting in yields exceeding 85%.
- Constructed 200 to 2000-nucleotide DNA nanostructures by utilizing both strands of one DNA duplex.
*This project resulted in two publications in **Nat. Commun.** (co-first author) and **J. Am. Chem. Soc.** (first author).*

Engineering Robust DNA Crystals with Stimuli-Responsiveness

- Enhanced the robustness of DNA crystals, enabling them to maintain excellent stability in challenging environments, including high temperatures, low ionic strength buffers, and organic solvents.
- Engineered DNA crystals capable of reversible expansion and contraction over 50 μm in response to external stimuli, such as pH, temperature, and chemical environment changes.
- Achieved controlled encapsulation and release of macromolecules, such as proteins and gold nanoparticles, by altering the chemical environment of the crystals.

*This project resulted in three publications: one in **Adv. Mater.** (first author) and two in **J. Am. Chem. Soc.** (contributing author).*

Designing Bivalent Thrombin DNA Aptamers Guided by Crystal Structures

- Developed a structure-guided approach for the rational design of bivalent DNA aptamers with pre-organized binding interactions.
- Designed a bivalent aptamer that binds to thrombin, demonstrating a 200-fold improvement in binding affinity compared to monomeric aptamers and 3-fold improvement over reported bivalent aptamers.

*This project resulted in one publication in **J. Am. Chem. Soc.** (co-first author).*

TEACHING EXPERIENCE

Teaching assistant, Purdue University

Aug. 2016 - July 2022

Course: General Chemistry/Organic Chemistry

- Developed online laboratory teaching materials for the General Chemistry course, including a set of demonstration experiment videos, in response to the need for remote learning during the COVID-19 pandemic.
- Contributed to building a fully online system for lectures, student engagement, and assignment grading using platforms such as Bridgespace, OneNote, and Microsoft Teams.
- Provided weekly recitations, held Q&A workshops, supervised lab experiments, and graded lab reports and exams for over 50 students each semester.

SERVICES & OUTREACH

Safety Representative, Lab of Chengde Mao
Purdue University

May 2017 - July 2022

Reviewer

Since 2023

Small, JACS Au, Inorganic Chemistry, Dalton Transactions, Crystal Growth & Design, ACS Applied Nano Materials, Sensing and Bio-Sensing Research, International Journal of Molecular Sciences, Gels, Materials.

PRESENTATIONS

The 36th Herbert. C. Brown Lectures, Purdue University, Apr. 2019. “*In Vivo* Production of RNA nanostructures”, *poster*.

PUBLICATIONS (‡ contributed equally)

1. Lifeng Zhou, Yanyu Xiong, Abhisek Dwivedy, **Mengxi Zheng**, Laura Cooper, Skye Shepherd, Tingjie Song, Wei Hong, Linh T.P. Le, Xin Chen, Saurabh Umrao, Lijun Rong, Tong Wang, Brian T. Cunningham, Xing Wang. Bioinspired Designer DNA NanoGripper for Virus Sensing and Potential Inhibition. *Sci. Robot.* **2024**, 9, eadi2084.
2. Saurabh Umrao, **Mengxi Zheng**, Xiaohe Jin, Sherwood Yao, Xing Wang. Net-Shaped DNA Nanostructure-Based Lateral Flow Assays for Rapid and Sensitive SARS-CoV-2 Detection. *Anal. Chem.* **2023**, 96, 3291-3299.
3. Longfei Liu, Dake Mao, Zhe Li, **Mengxi Zheng**, Kai He, Chengde Mao. Surface-assisted self-assembly of 2D, DNA binary crystals. *Nanoscale* **2023**, 15, 9941-9945.
4. Ruixin Li, **Mengxi Zheng**, Anirudh S. Madhvacharyula, Yancheng Du, Chengde Mao, Jong Hyun Choi. Mechanical deformation behaviors and structural properties of ligated DNA crystals. *Biophys. J.* **2022**, 121, 4078-4090.
5. Cuizheng Zhang‡, **Mengxi Zheng‡**, Yoel Ohayon, Simon Vecchioni, Ruojie Sha, Nadrian Seeman, Natasha Jonoska, Chengde Mao. Programming DNA Self-Assembly by Geometry, Not Sequence. *J. Am. Chem. Soc.* **2022**, 144, 8741-8745.
6. **Mengxi Zheng‡**, Zhe Li‡, Cuizheng Zhang, Nadrian C. Seeman, Chengde Mao. Powering ≈ 50 μM Motion by a Molecular Event in DNA crystals. *Adv. Mater.* **2022**, 34, 2200441.
7. Xiaoli Hu‡, Linlin Tang‡, **Mengxi Zheng‡**, Jian Liu, Zhe Zhang, Zhe Li, Quan Yang, Shoubo Xiang, Liang Fang, Qiao Ren, Xuemei Liu, Chengzhi Huang, Chengde Mao, Hua Zuo. Structure-Guided Designing Pre-Organization in Bivalent Aptamers. *J. Am. Chem. Soc.* **2022**, 144, 4507-4514.
8. **Mengxi Zheng**, Zhe Li, Longfei Liu, Mo Li, Victoria E. Paluzzi, Jong Hyun Choi, Chengde Mao. Kinetic DNA Self-Assembly: Simultaneously Co-folding Complementary DNA Strands into Identical Nanostructures. *J. Am. Chem. Soc.* **2021**, 143, 20363–20367.
9. Zhe Li, **Mengxi Zheng**, Longfei Liu, Nadrian C. Seeman, Chengde Mao. 5'-Phosphorylation Strengthens Sticky-End Cohesions. *J. Am. Chem. Soc.* **2021**, 143, 14987-14991.
10. **Mengxi Zheng**, Qian Li, Qian Li, Victoria E. Paluzzi, Jong Hyun Choi, Chengde Mao. Engineering the Nanoscaled Morphologies of Linear DNA Homopolymers. *Macromol. Rapid Commun.* **2021**, 2100217.
11. Kai He, Zhe Li, Longfei Liu, **Mengxi Zheng**, Chengde Mao. Assembly of a DNA origami Chinese Knot by only 15% of the staple strands. *ChemBioChem.* **2020**, 21, 2100217.
12. Zhe Li, Longfei Liu, **Mengxi Zheng**, Jiemin Zhao, Nadrian C. Seeman, Chengde Mao. Making Engineered 3D DNA Crystals Robust. *J. Am. Chem. Soc.* **2019**, 141, 15850–15855.
13. Longfei Liu, **Mengxi Zheng**, Zhe Li, Qian Li, Chengde Mao. Patterning Nanoparticles with DNA Molds. *ACS Appl. Mater. Interfaces* **2019**, 11, 13853–13858.
14. Mo Li‡, **Mengxi Zheng‡**, Siyu Wu, Cheng Tian, Di Liu, Yossi Weizmann, Wen Jiang, Guansong Wang, Chengde Mao. In vivo production of RNA nanostructures via programmed folding of single-stranded RNAs. *Nat. Commun.* **2018**, 9, 2196.

15. Shuguang Chen, Hailang Jia, Mengxi Zheng, Kang Shen, Hegen Zheng. Insight into the effects of modifying π -bridges on the performance of dye-sensitized solar cells containing triphenylamine dyes. *Phys Chem Chem Phys*. **2016**, 18, 29555-29560.
16. Xiangjing Gao, **Mengxi Zheng**, Ling Qin, Kang Shen, Hegen Zheng. Properties of Four Metal–Organic Frameworks Based on a N-Centered Multidentate Pyridine-Carboxylate Bifunctional Ligand. *Cryst. Growth Des.* **2016**, 16, 4711–4719.
17. Jian Qu, Yinglin Song, Wei Ji, Su Jing, Dunru Zhu, Wei Huang, **Mengxi Zheng**, Yanle Li, Jing Ma. Macrocyclic $\text{Se}_4\text{N}_2[7,7]$ ferrocenophane and $\text{Se}_2\text{N}[10]$ ferrocenophane containing benzyl unit: synthesis, complexation, crystal structures, electrochemical and optical properties. *Dalton Trans.* **2016**, 45, 3417-3428.
18. **Meng-Xi Zheng**, Xiang-Jing Gao, Chuan-Lei Zhang, Ling Qin, He-Gen Zheng. Assembly of various degrees of interpenetration of Co-MOFs based on mononuclear or dinuclear cluster units: magnetic properties and gas adsorption. *Dalton Trans.* **2015**, 44, 4751-4758.
19. Ling Qin, **Mengxi Zheng**, Zijian Guo, Hegen Zheng, Yan Xu. One Non-interpenetrated Chiral Porous Multifunctional Metal–Organic Framework and Its Applications for Sensing Small Solvent Molecules and Adsorption. *Chem. Commun.* **2015**, 51, 2447-2449.

BOOK CHAPTER

1. **Mengxi Zheng**, Victoria E. Paluzzi, Cuizheng Zhang, Chengde Mao, Toward Production of Nucleic Acid Nanostructures in Life Cells and Their Biomedical Applications, *DNA Nanotechnology for Cell Research: From Bioanalysis to Biomedicine*, Wiley, **2024**.
2. Chengde Mao, Victoria Paluzzi, **Mengxi Zheng**, Dake Mao, Cuizheng Zhang, Self-assembled DNA nanostructures, *Encyclopedia of Nanomaterials*, Elsevier, **2023**.