Supporting information

Mechanism-Informed Computational Design of RNA Aptamers for Unmodified AuNP Colorimetric Sensing of C16-Ceramide

[1§]Yiting Li[†], [1]Hongyu Chen[†], [2]Yaqiong Yang* and [1]Dengming Ming*

[1] *College of Biotechnology and Pharmaceutical Engineering, Nanjing Tech University, Nanjing 210023, PR China*

[2] *College of Food and Pharmaceutical Engineering, Nanjing Normal University, Nanjing 211816, PR China*

* Corresponding author: Yaqiong Yang (yangyq@njnu.edu.cn), Dengming Ming (dming@njtech.edu.cn)

[§]Now in the Institute of Biopharmaceutical and Health Engineering, Shenzhen International Graduate School, Tsinghua University, Shenzhen 518055, PR China

[†]Equally contributed to this work.

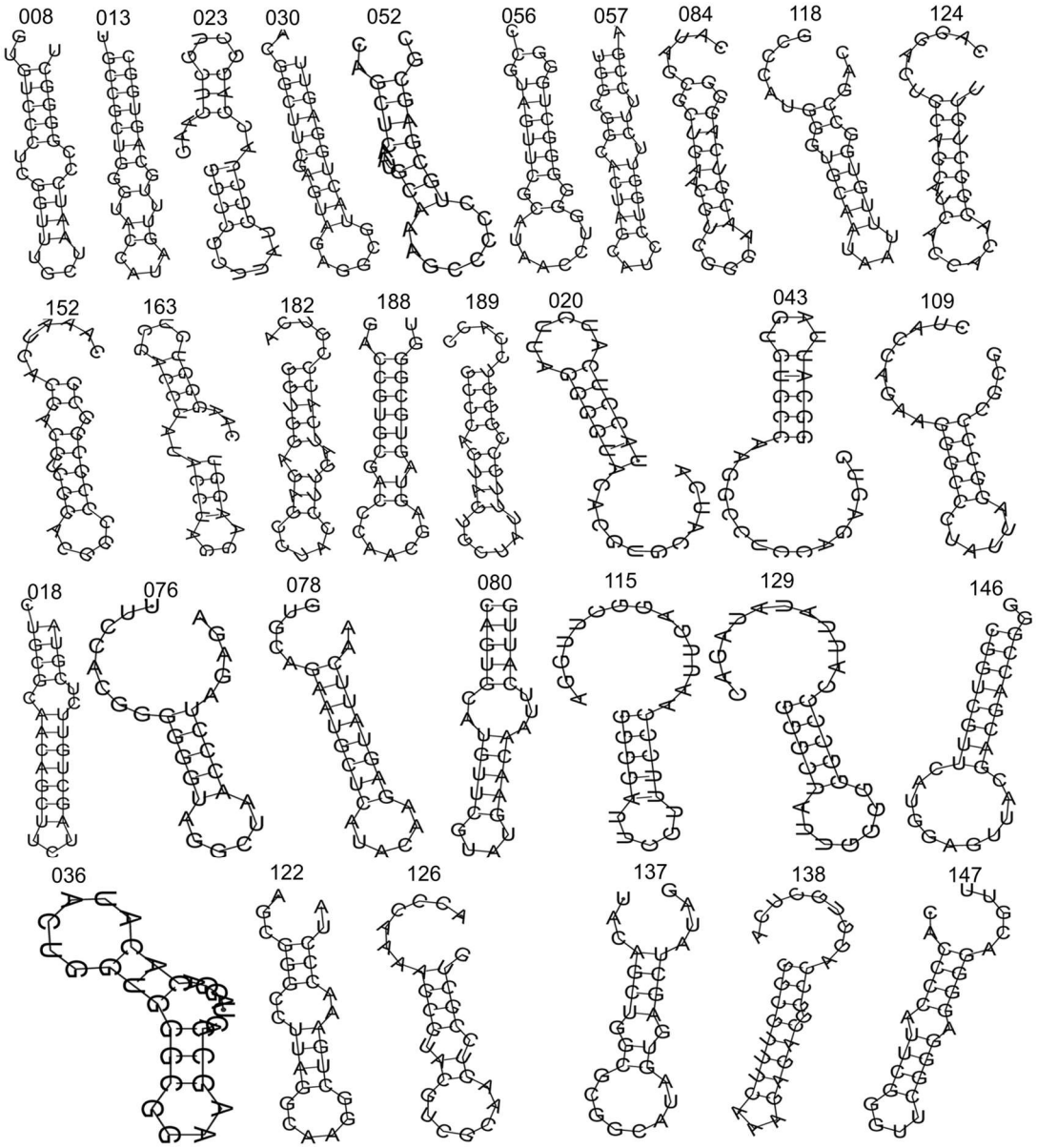

Fig S1. Secondary structures of RNA aptamers obtained in the first round of screening.

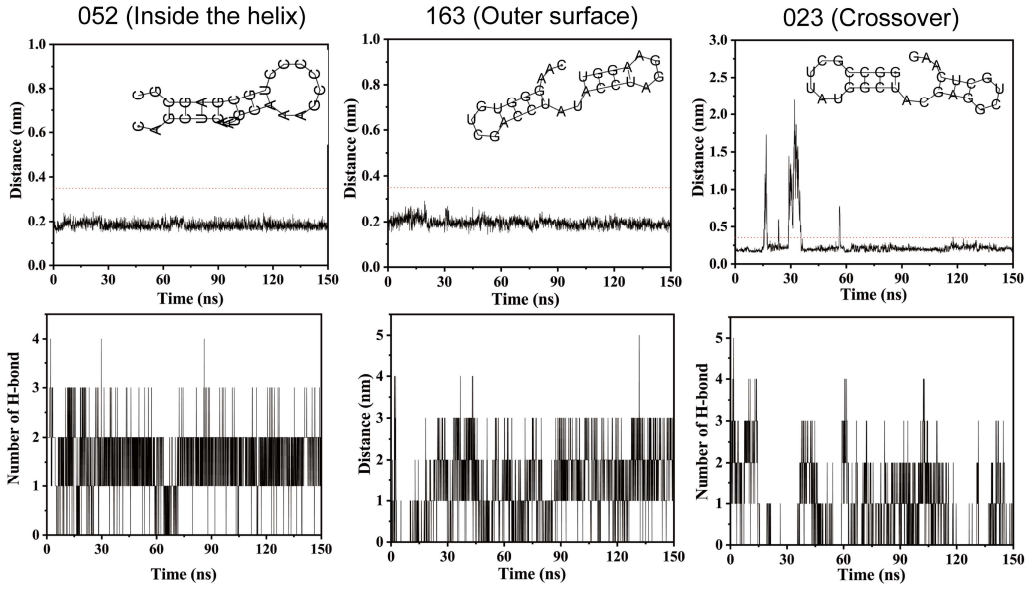

Fig S2. Interaction between RNA and C16-ceramide: the minimum distance between RNA and ceramide (line1), and the number of hydrogen bonds between ceramide and RNA molecules within the simulated duration of 150 ns (line2).

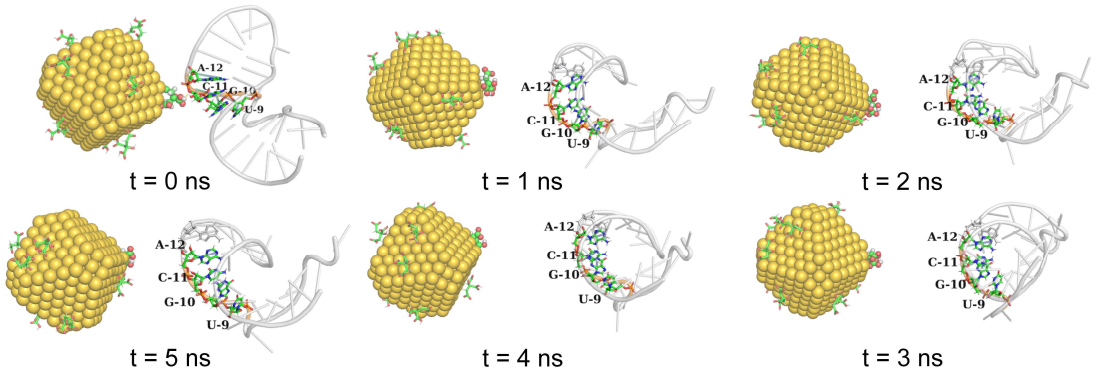

Fig S3. Representative trajectories from 5 ns MD simulation of apo-state RNA052 and AuNP on the initial position near 11C region.

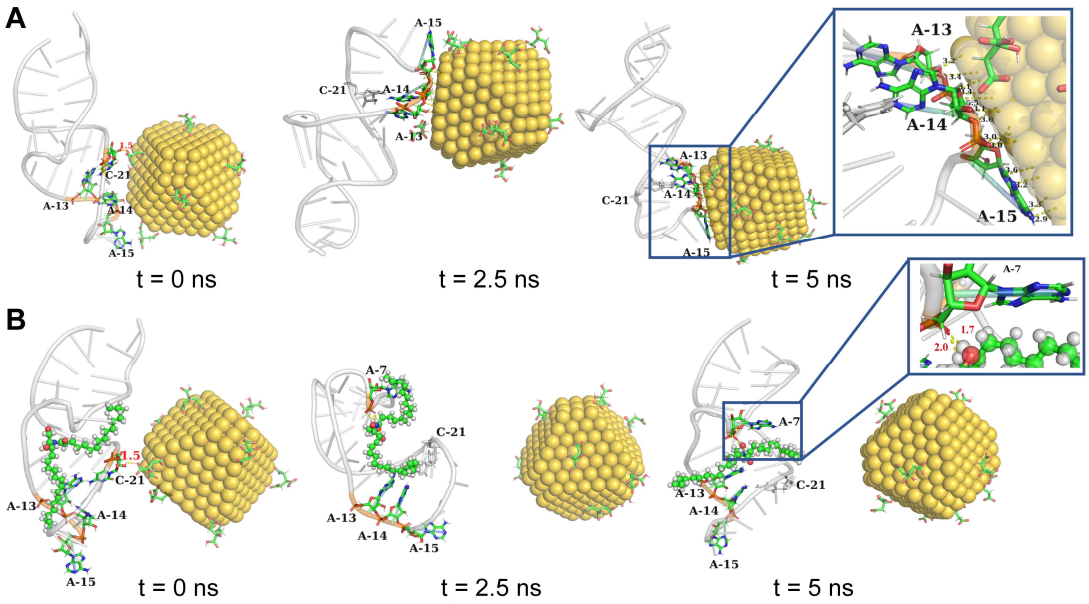

Fig S4. Comparison of RNAm4–AuNP interactions in the absence and presence of C16-ceramide for the 21C starting configuration. (A) Apo-state RNAm4–AuNP system. (B) RNAm4–ceramide–AuNP system. Representative trajectories from the 5 ns MD simulations are shown.

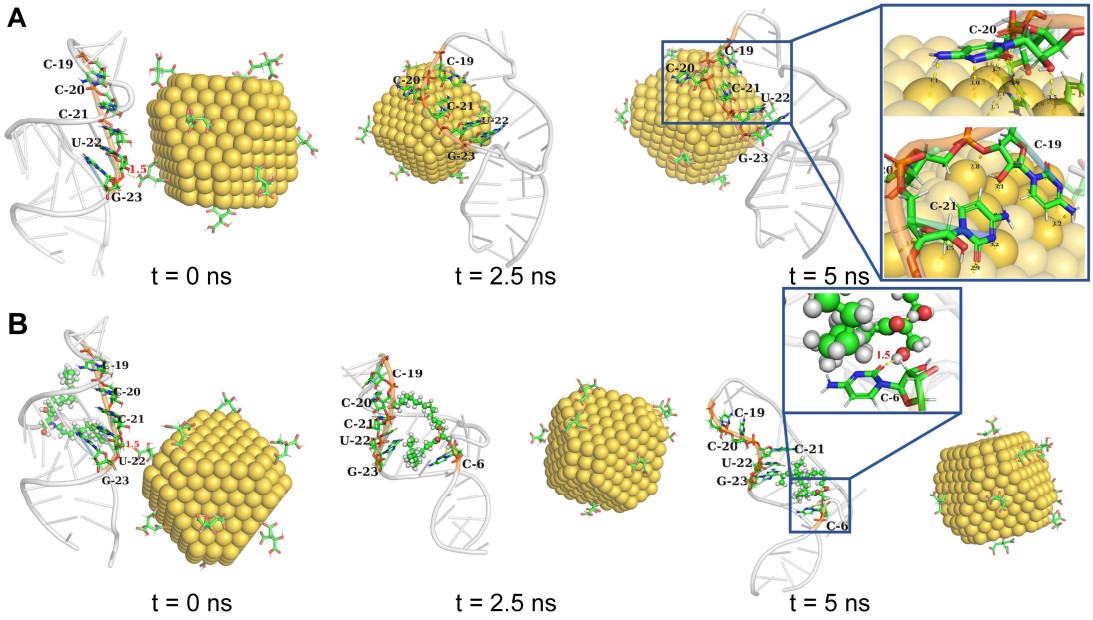

Fig S5. Comparison of RNAm4–AuNP interactions in the absence and presence of C16-ceramide for the 22U starting configuration. (A) Apo-state RNAm4–AuNP system. (B) RNAm4–ceramide–AuNP system. Representative trajectories from the 5 ns MD simulations are shown.

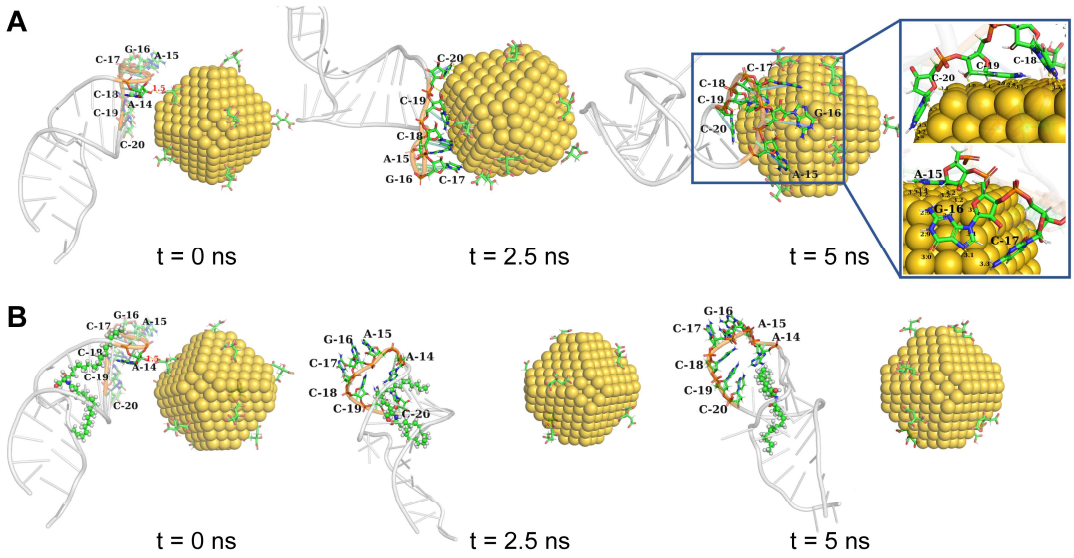

Fig S6. Comparison of RNAm4–AuNP interactions in the absence and presence of C16-ceramide for the 14A starting configuration. (A) Apo-state RNAm4–AuNP system. (B) RNAm4–ceramide–AuNP system. Representative trajectories from the 5 ns MD simulations are shown.

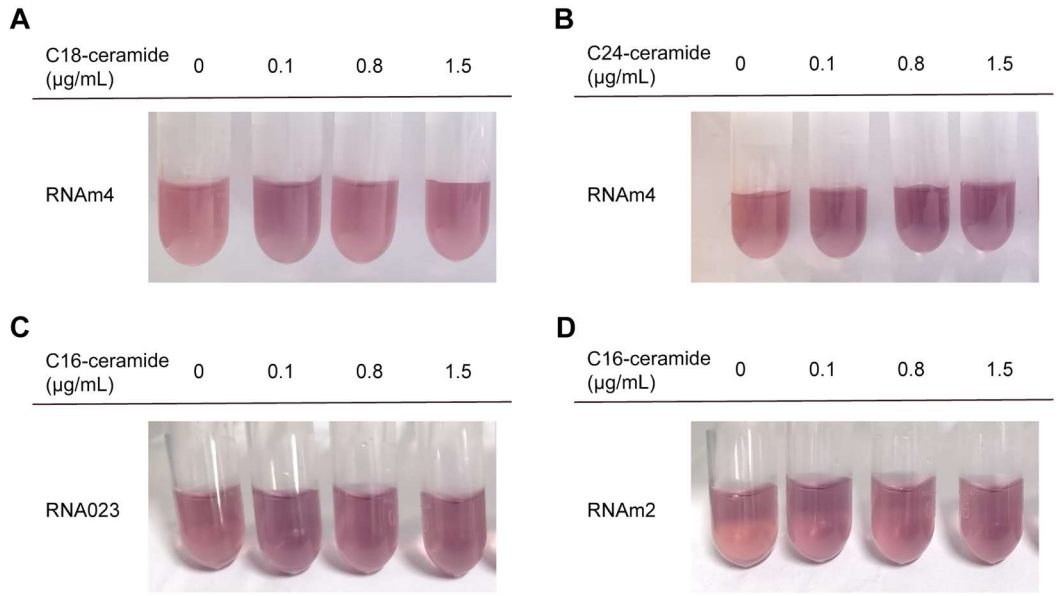

Fig S7. Experimental validation of specificity and negative-control sequences in the computational prioritization cascade for AuNP-compatible aptamers. (A) Colorimetric response of the AuNP–RNAm4 sensor challenged with varying concentrations of C18-ceramide. (B) Colorimetric response of the AuNP–RNAm4 sensor challenged with varying concentrations of C24-ceramide. (C) Colorimetric response of the AuNP–

RNA023 control system across varying C16-ceramide concentrations. (D) Colorimetric response of the AuNP–RNAm2 control system across varying C16-ceramide concentrations.