# Literature Report

**Reporter: Liu Weiwei**

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EDGE ARTICLE

# Efficient and selective DNA modification on bacterial membranes

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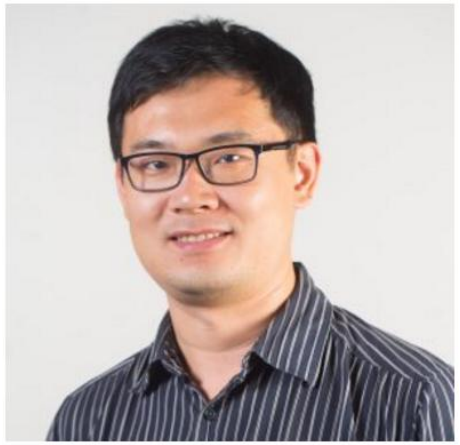

**Dr. Mingxu You**

Department of Chemistry,
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- B.S. degree in Chemistry from Peking University in 2008
- Ph.D. degree in Chemistry from the University of Florida in 2012, developing DNA-based devices for cancer diagnosis, targeted drug delivery, and cell membrane biophysical studies.
- Prior to join UMass, he pursued his postdoctoral research with Prof. Samie R. Jaffrey at Weill Medical College of Cornell University, interested in developing RNA-based fluorescent sensors for imaging metabolites and signaling molecules in live cells

(1) Biosensors and Bioimaging

(2) Cell Membrane Biophysics

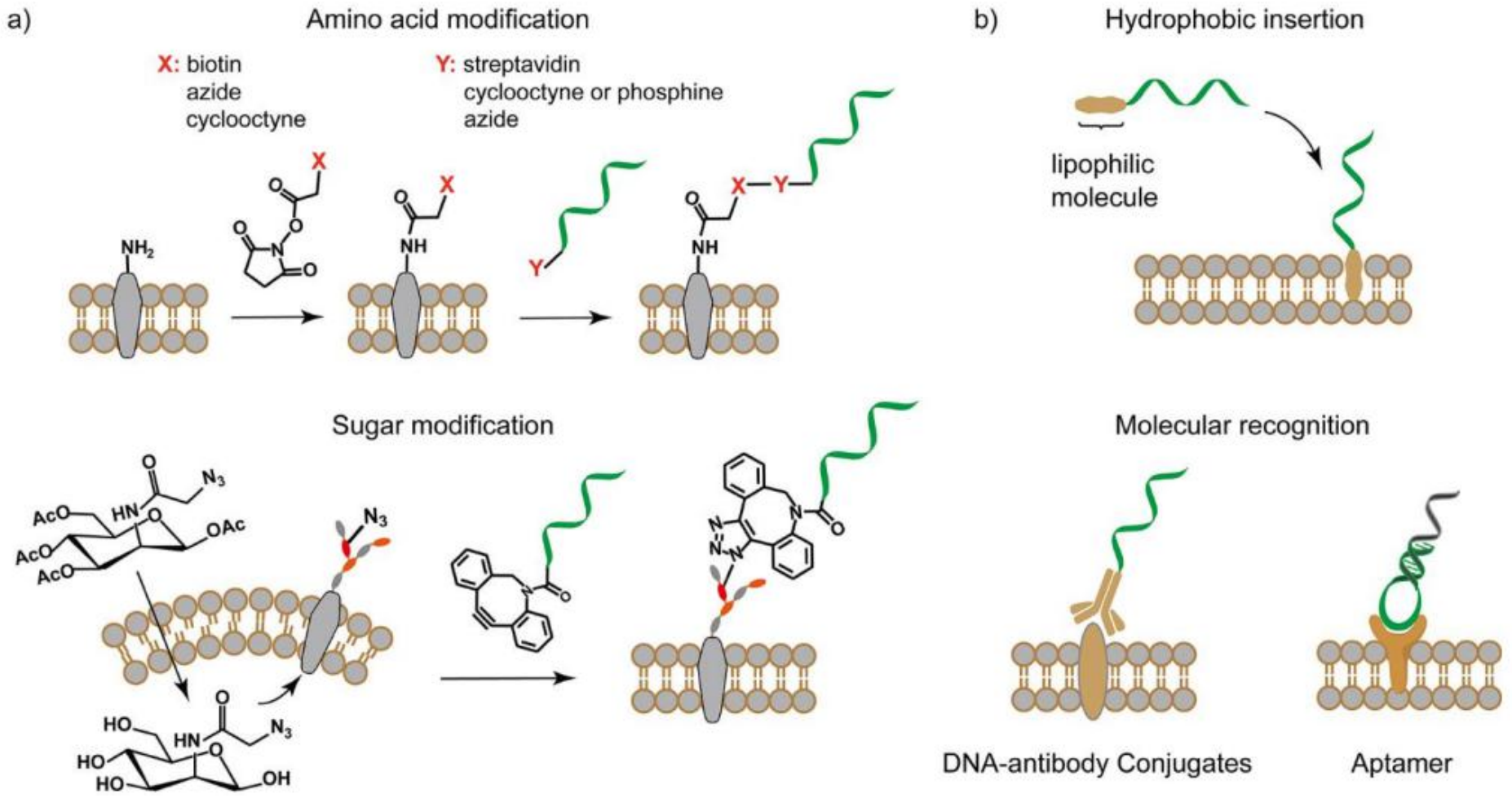
(3) DNA/RNA Nanotechnology

(4) SELEX

(5) Photo-controlled Devices

# Introduction

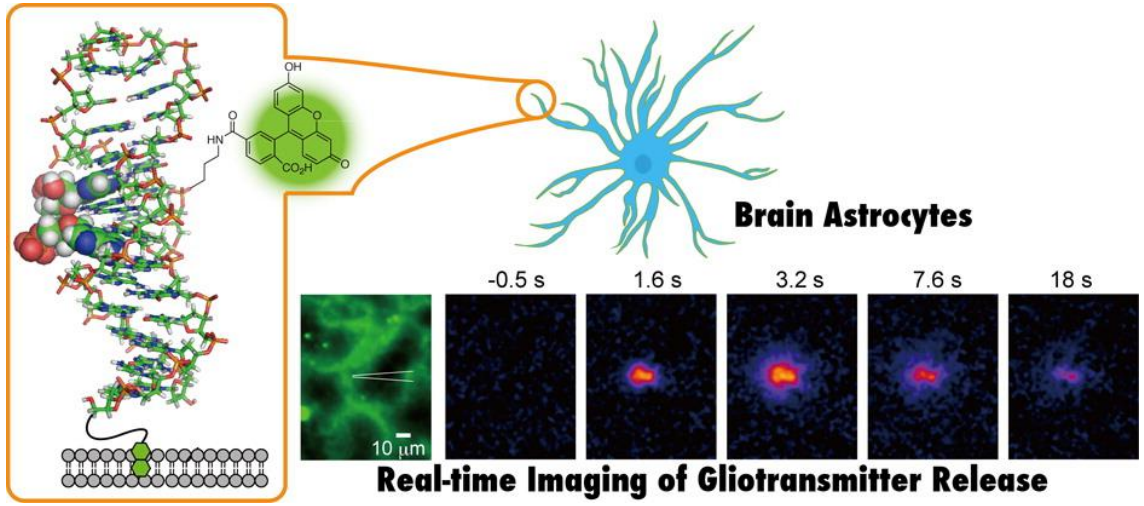
Synthetic DNA for Cell Surface Engineering



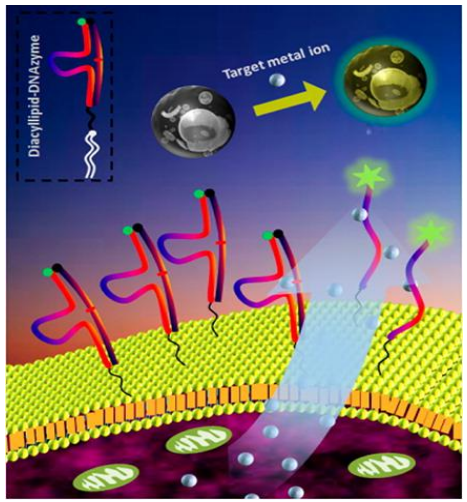

Angew. Chem. Int. Ed. 10.1002/anie.202010278

# Introduction

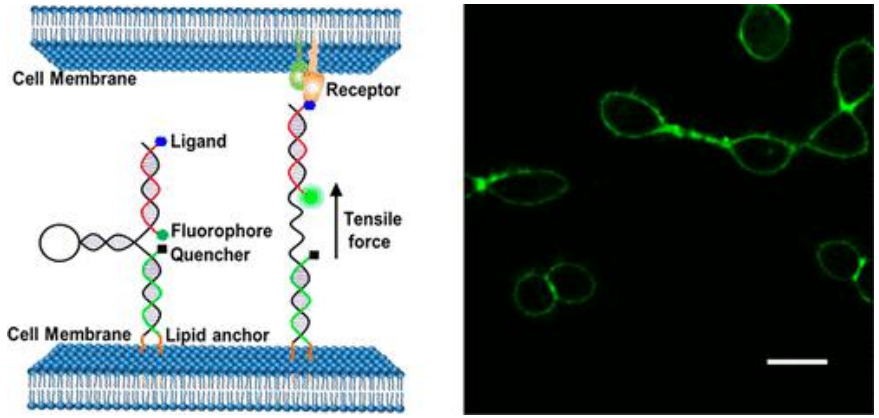
Lipid-DNA conjugates for cell membrane analysis




J. Am. Chem. Soc. 2012, 134, 23, 9561–9564




J. Am. Chem. Soc. 2014, 136, 13090-13093

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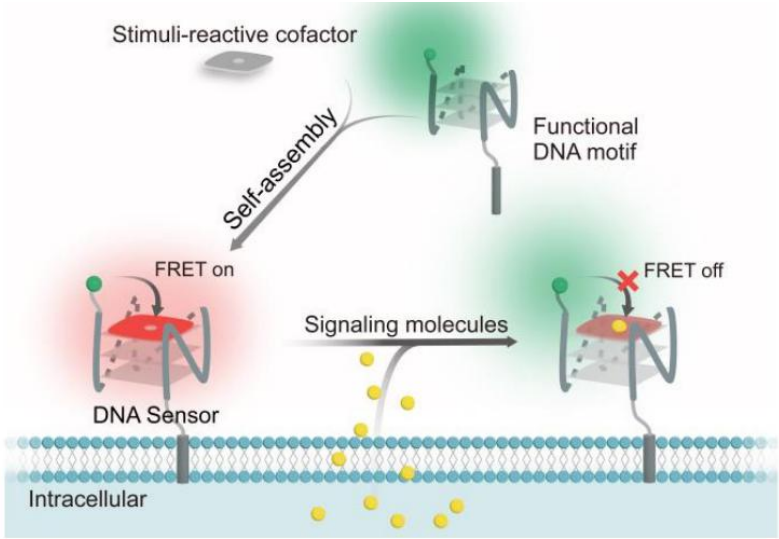
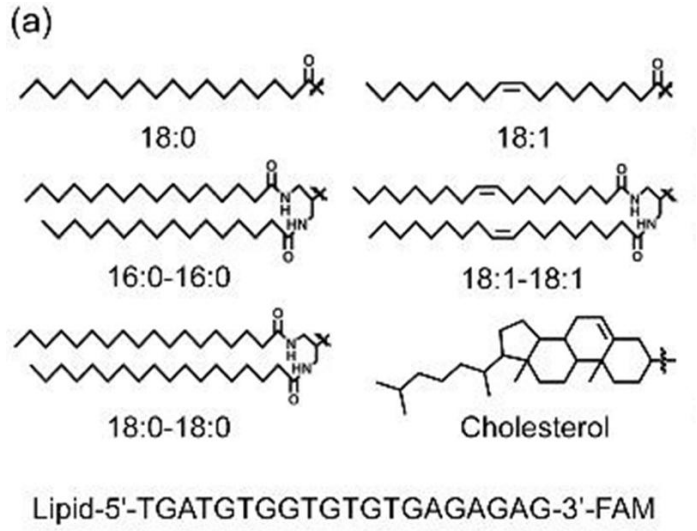
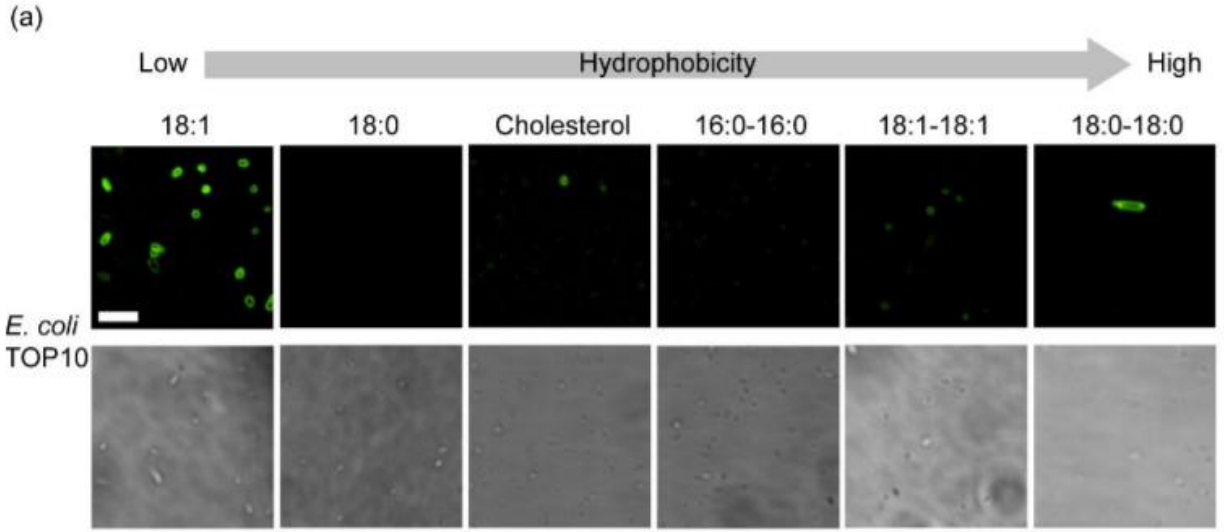
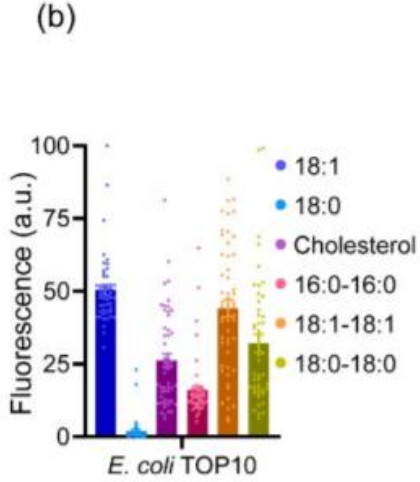


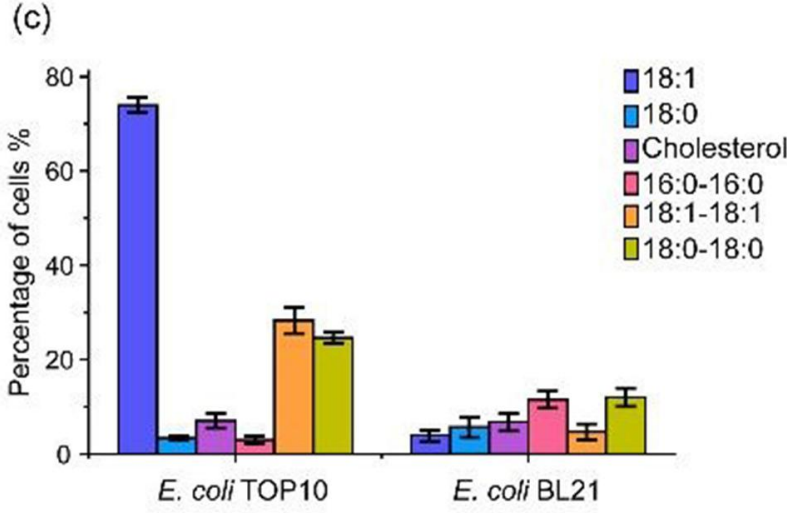

Angew. Chem. Int. Ed. 10.1002/anie.201901320

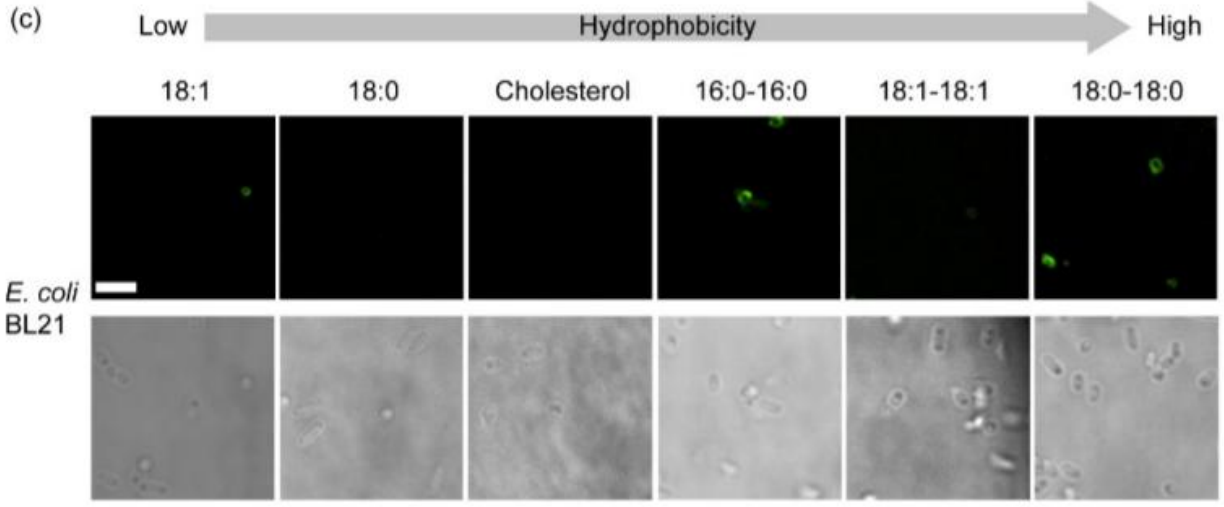
# Design and bacterial membrane insertion of lipid-DNA conjugates

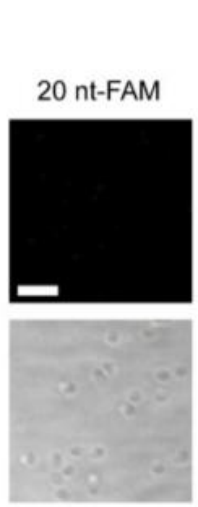


# Design and bacterial membrane insertion of lipid-DNA conjugates

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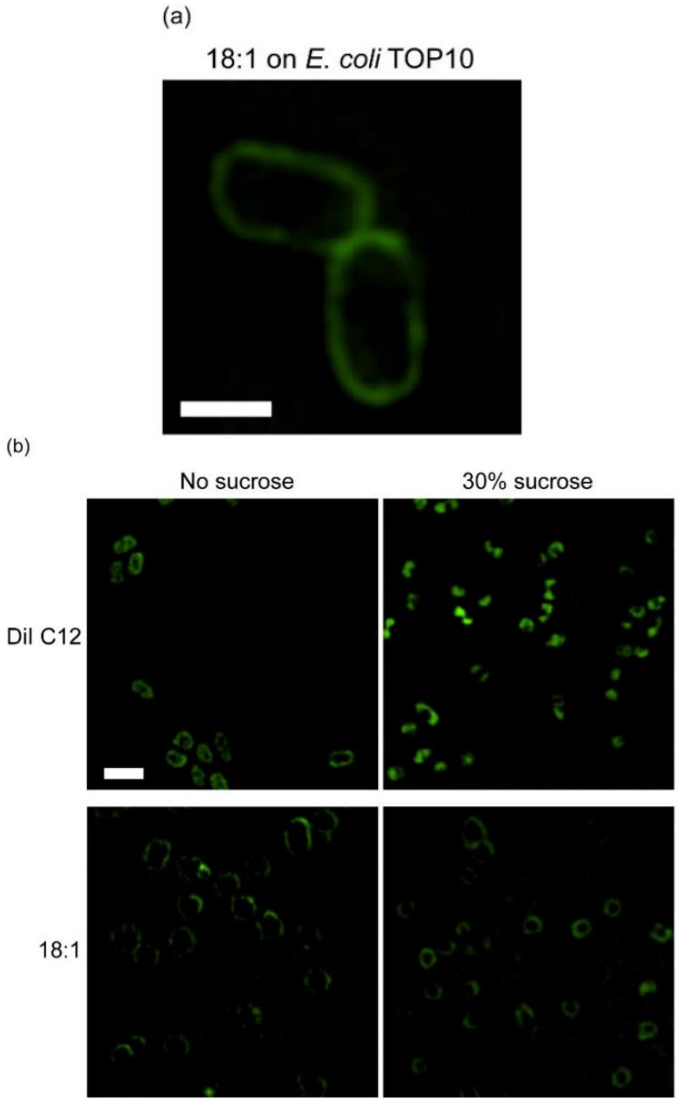
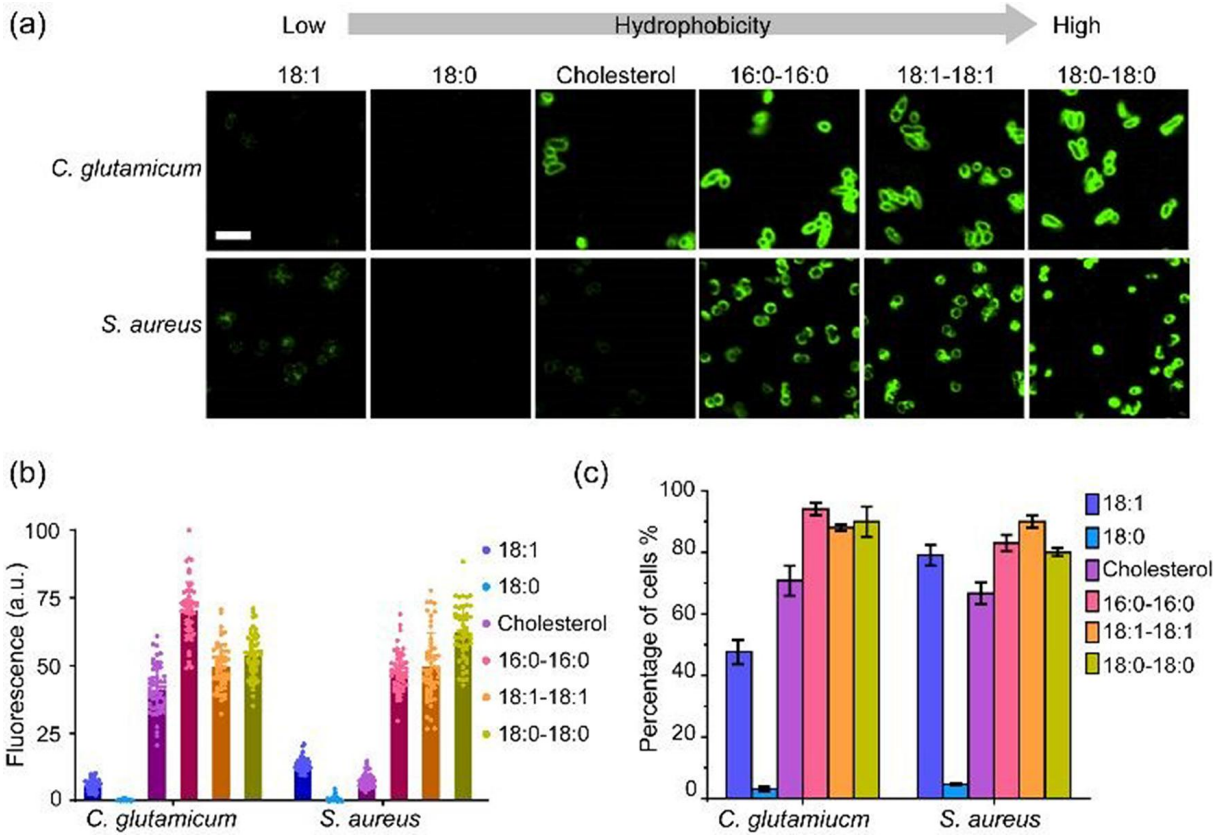
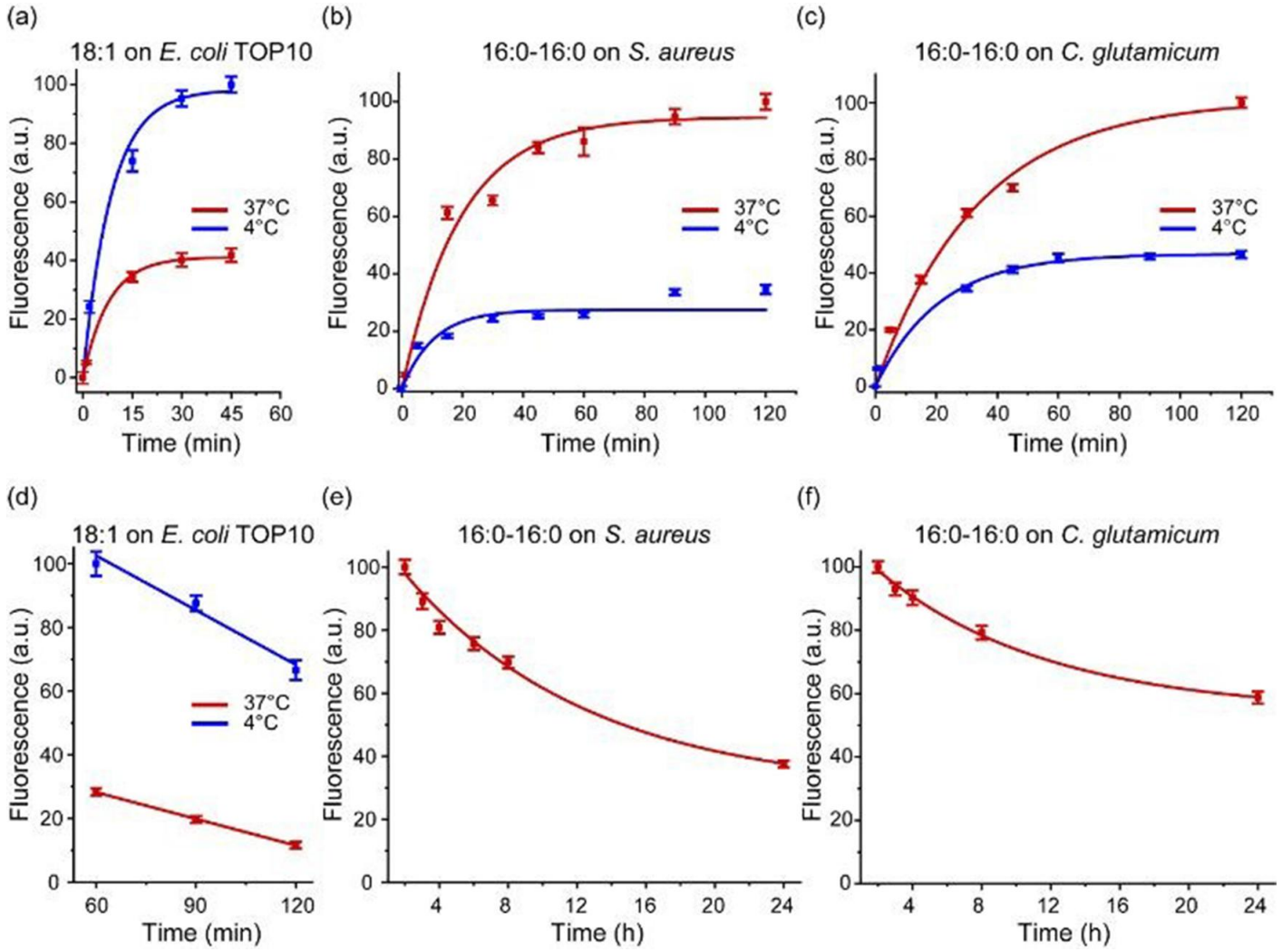


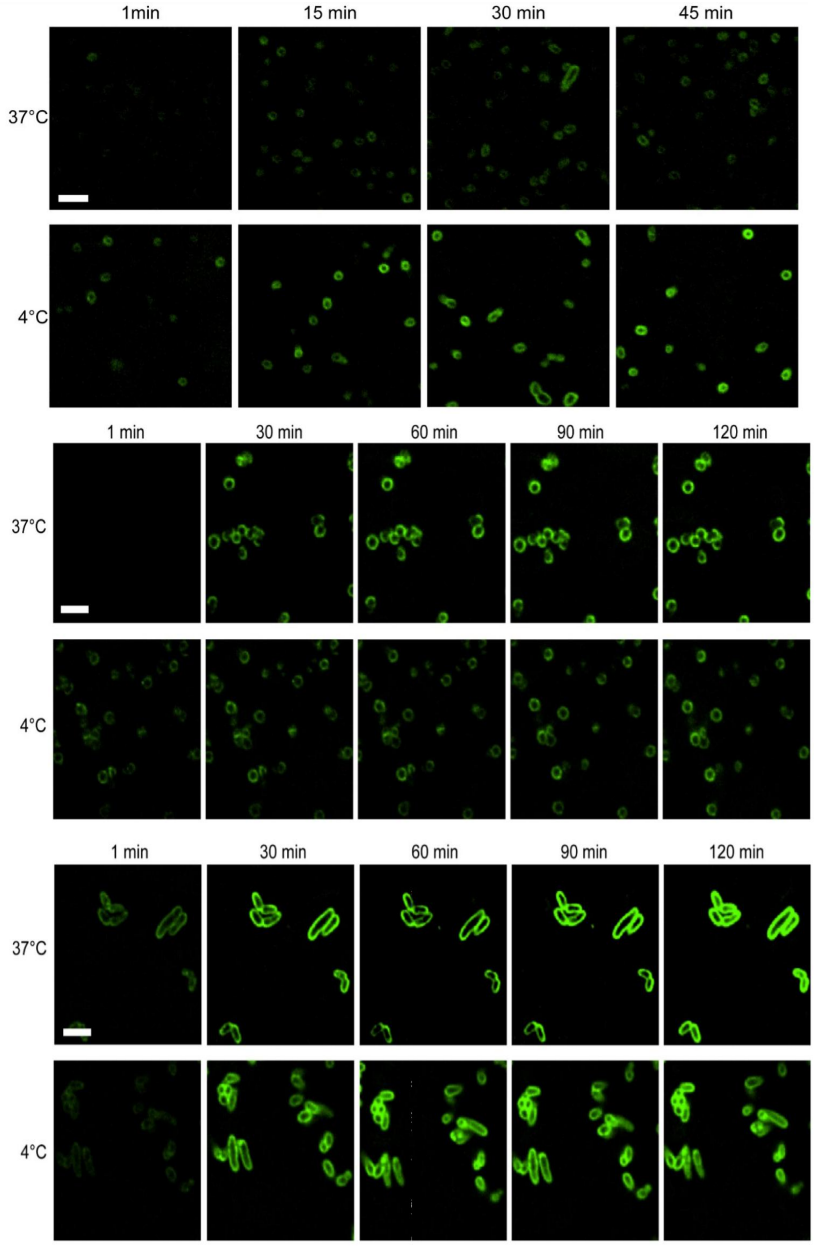

Table S2. Bacterial membrane modification percentageof each lipid-DNA conjugate.

| | *E. coli* TOP10 | *E. coli* BL21 | *P. aeruginosa* | *C. glutamicum* | *S. aureus* | *M. luteus* |
|---|---|---|---|---|---|---|
| 18:1 | 84 ± 4.4 | 8.1 ± 0.9 | <1.0 | 52 ± 5.5 | 87 ± 2.8 | 5.4 ± 0.5 |
| 18:0 | 3.9 ± 0.6 | 7.0 ± 1.4 | <1.0 | 4.7 ± 0.8 | 5.5 ± 1.7 | <1.0 |
| Cholesterol | 9.9 ± 0.9 | 10 ± 2.3 | <1.0 | 71 ± 1.1 | 77 ± 3.7 | 11 ± 1.8 |
| 16:0-16:0 | 4.8 ± 0.4 | 13 ± 1.3 | <1.0 | 94 ± 2.9 | 83 ± 2.1 | <1.0 |
| 18:1-18:1 | 31 ± 1.9 | 6.7 ± 1.2 | <1.0 | 88 ± 2.0 | 90 ± 1.2 | 8.8 ± 2.8 |
| 18:0-18:0 | 33 ± 3.2 | 17 ± 1.6 | <1.0 | 90 ± 1.4 | 80 ± 5.2 | <1.0 |



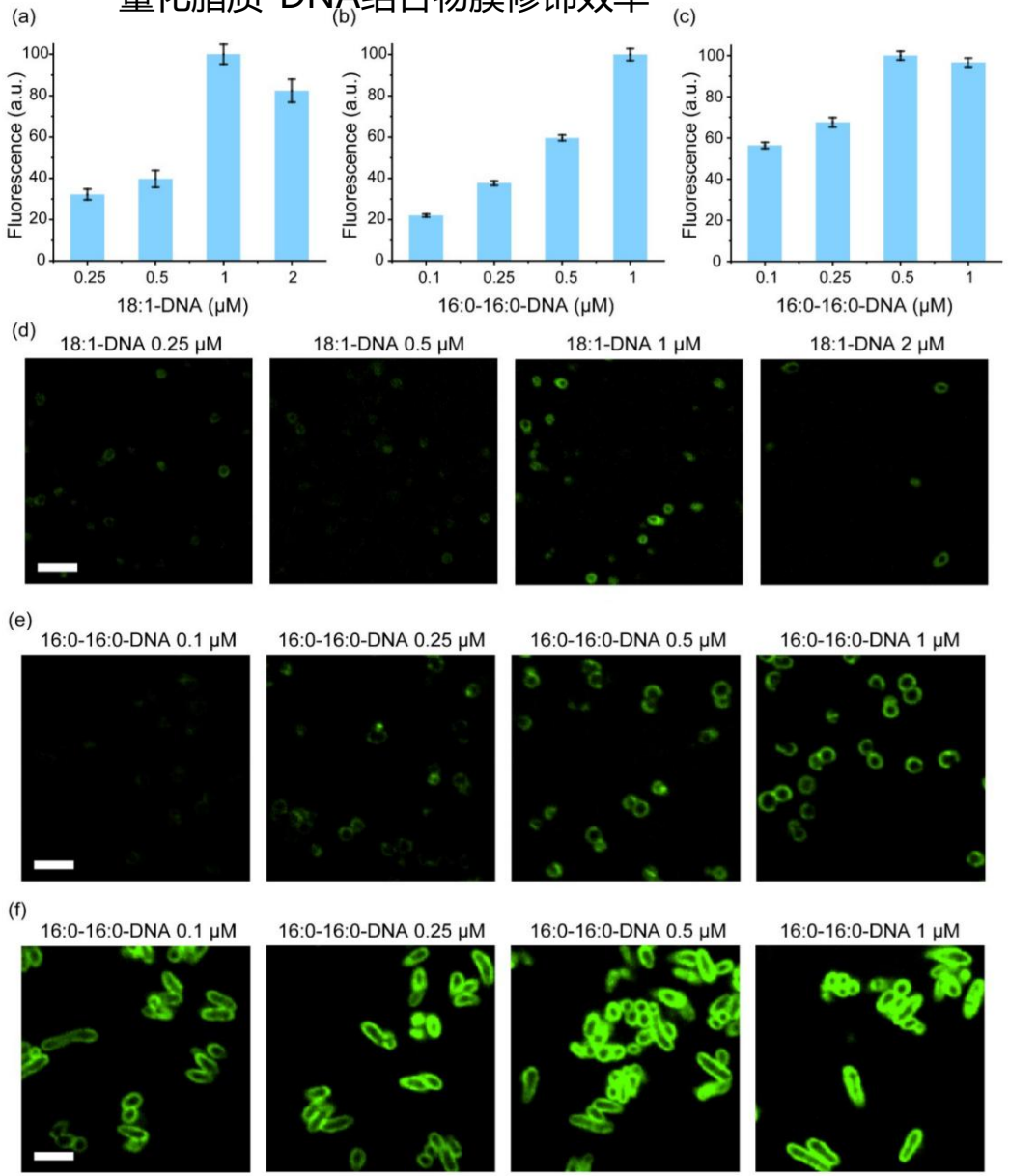
# Membrane insertion kinetics & persistence of lipid-DNA conjugates



# Membrane modification efficiency of lipid-DNA conjugates

量化脂质-DNA结合物膜修饰效率



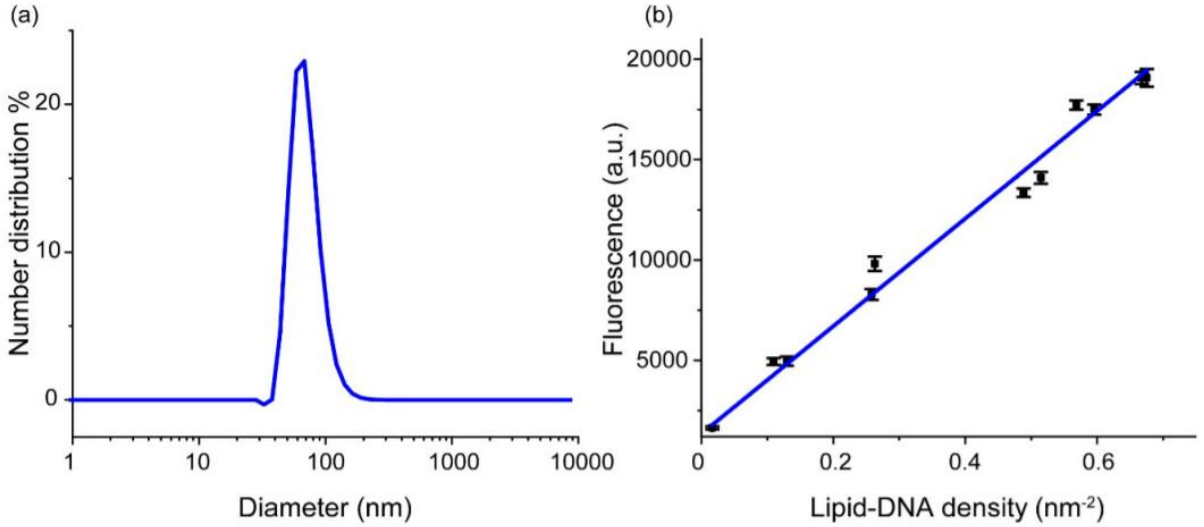
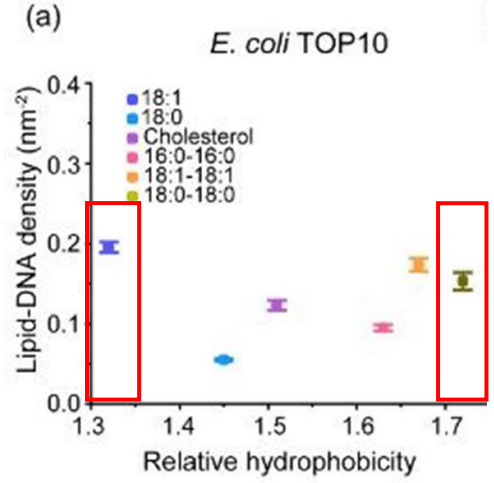




**Table S3.** Maximum bacterial membrane density of each lipid-DNA conjugate (unit: nm-2).

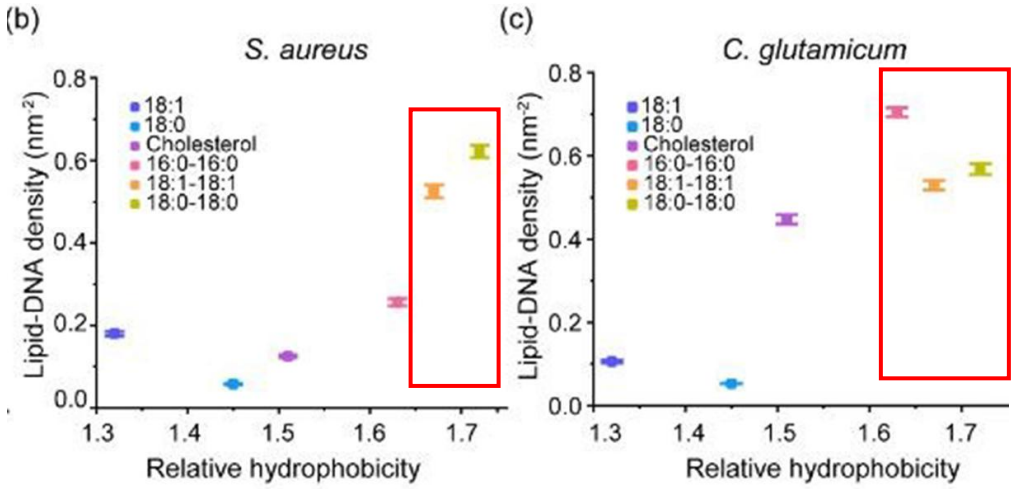
| | 18:1 | 18:0 | Cholesterol | 16:0-16:0 | 18:1-18:1 | 18:0-18:0 |
|---|---|---|---|---|---|---|
| *E. coli* TOP10 | 0.20 ± 0.01 | 0.06 ± 0.01 | 0.12 ± 0.01 | 0.10 ± 0.01 | 0.17 ± 0.01 | 0.15 ± 0.01 |
| *S. aureus* | 0.18 ± 0.01 | 0.06 ± 0.01 | 0.13 ± 0.01 | 0.26 ± 0.01 | 0.53 ± 0.02 | 0.62 ± 0.02 |
| *C. glutamicum* | 0.11 ± 0.01 | 0.05 ± 0.01 | 0.45 ± 0.01 | 0.71 ± 0.01 | 0.53 ± 0.10 | 0.57 ± 0.01 |

# Effect of lipid-DNA hydrophobicity on the membrane insertion

细菌膜疏水性的影响

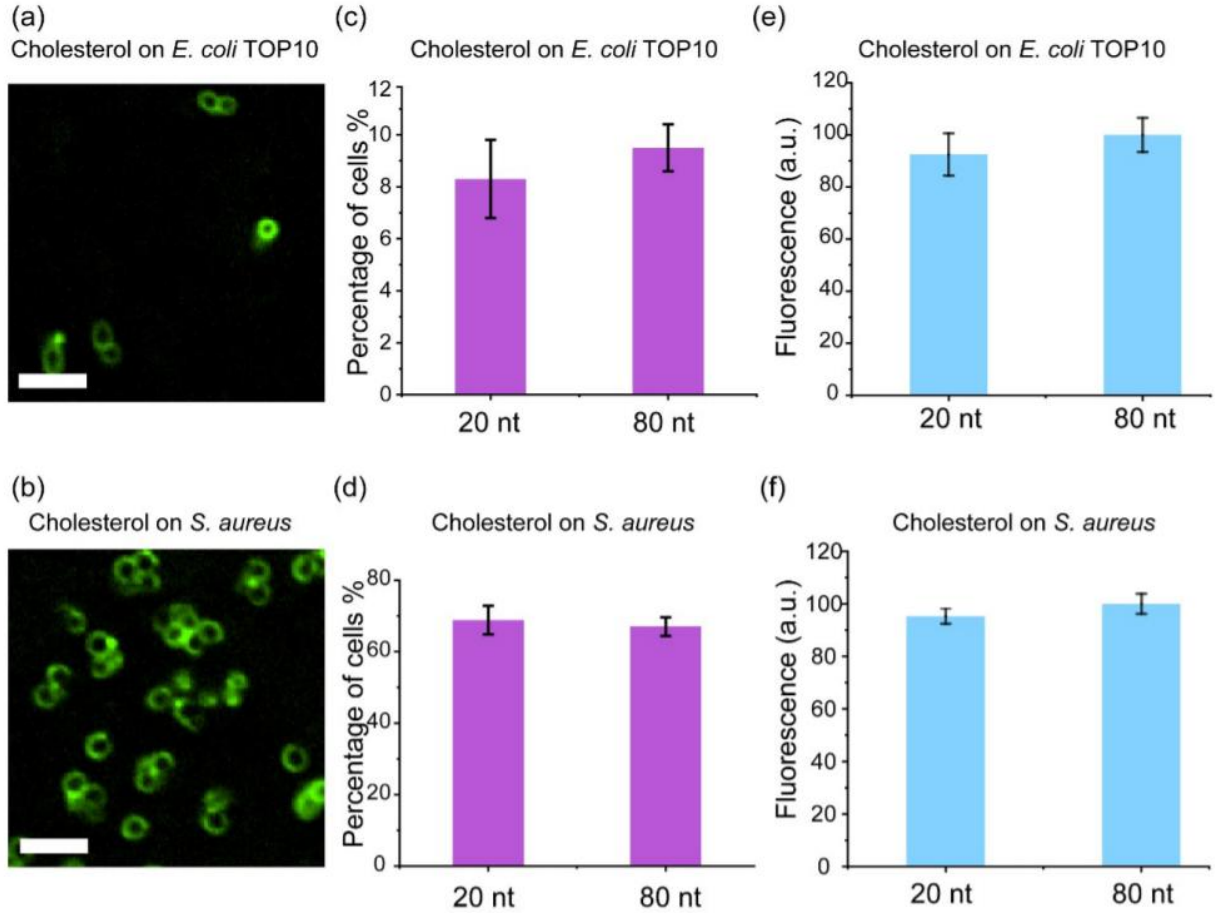



由于外膜上存在脂多糖链
而具有更强的亲水性



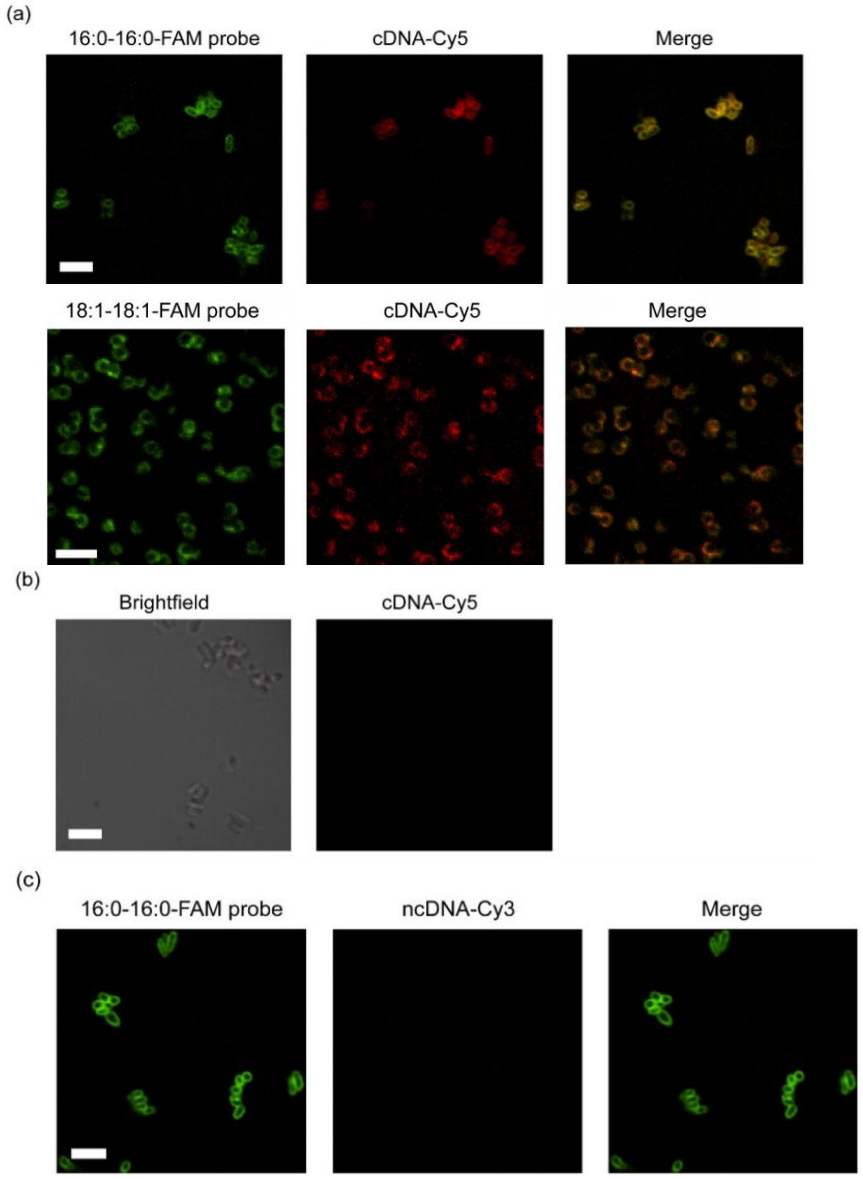

膜含有大量高度疏水的支链氨基酸和脂肪酸

DNA长度的影响



# Selective targeting and detection of bacteria

DNA杂交




检测混合菌液中的细菌

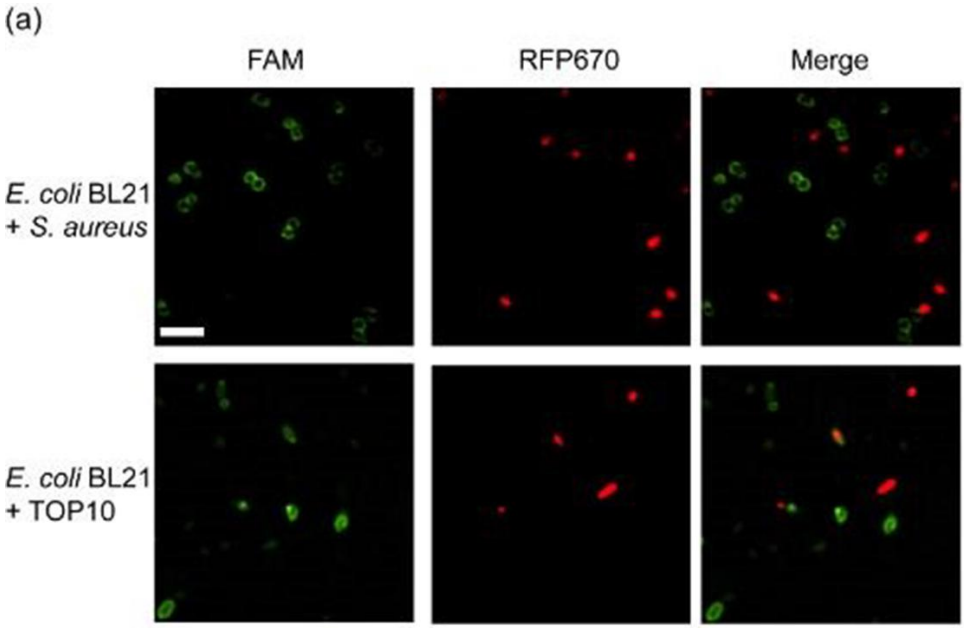
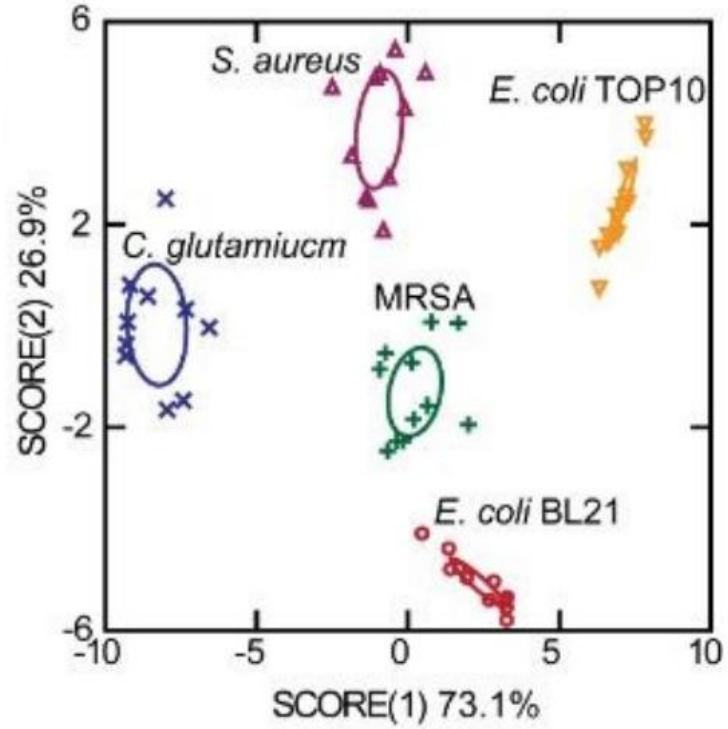



**Figure 5a.** (Top) FAM-labeled 18:1-18:1-DNA conjugate can be used to distinguish S. aureus cells from a mixture with RFP670-expressing E. coli BL21 cells. (Bottom) Similarly, FAM-labeled 18:1-DNA conjugate was used to distinguish E. coli TOP10 cells from a mixture with BL21. Here, 1 µM of the lipid-DNA conjugate was incubated with the cell mixture for 1 h at 37°C. Scale bar, 5 µm.

# Selective targeting and detection of bacteria

检测混合菌液中的细菌



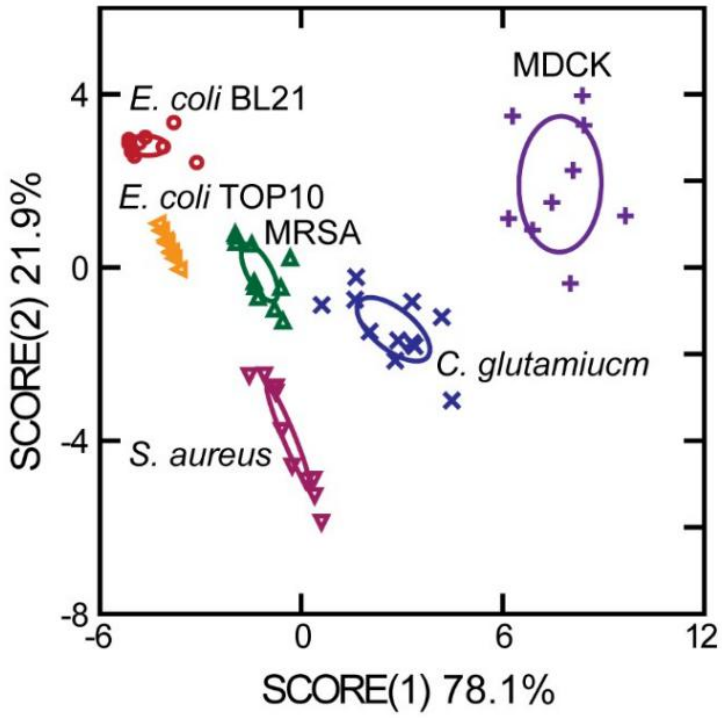




**Figure 5b**: Linear discriminant analysis based on the fluorescence response pattern of the 18:1-DNA and 16:0-16:0-DNA conjugates on five types of bacterial strains. The transformed canonical scores were plotted with 95% confidence ellipses around the centroid of each group.

**Figure S11**. Linear discriminant analysis based on the fluorescence response pattern of the 18:1-18:1-DNA and cholesterol-DNA conjugates on five types of bacterial strains and MDCK cells. The transformed canonical scores were plotted with 95% confidence ellipses and 0.001 tolerance around the centroid of each group.