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THMS Switching in Liquid Crystals Enables Optical Antibiotic Sensing: Demonstrated with Tobramycin

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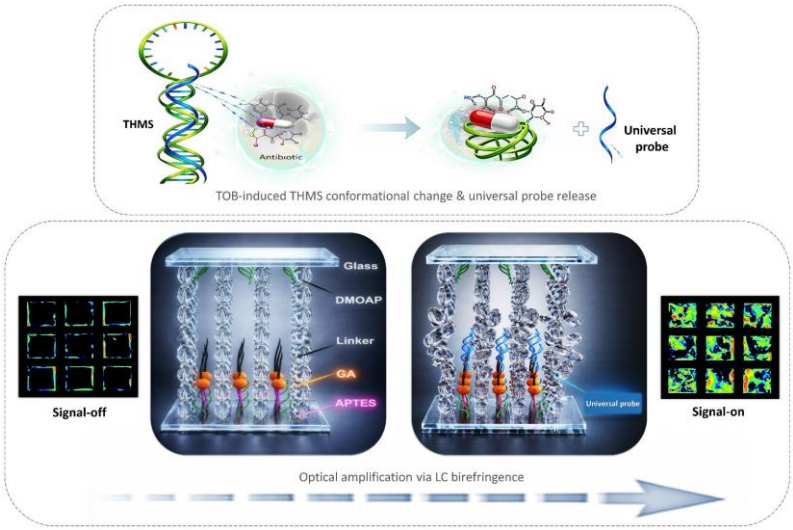
Liquid crystals (LCs) are highly sensitive to molecular organization at interfaces, enabling the amplification of nanoscale molecular events into macroscopic optical signals. Here we present a sensing strategy coupling a Triple Helix Molecular Switch (THMS) with LC-based optical readout for antibiotic detection, demonstrated using tobramycin. Tobramycin binding induces a conformational transition in the THMS, releasing a probe strand that hybridizes with a surface-immobilized linker. This secondary recognition event perturbs the orientational order at the LC interface, triggering distinct optical texture transitions observable via polarized optical microscopy. Formation and switching of the THMS were confirmed by agarose gel electrophoresis and complementary characterization. In this system, the LC phase acts as an amplification platform, converting DNA structural switching into detectable macroscopic signals. By integrating responsive DNA nanostructures with LC soft matter, this approach enables label-free sensing. This strategy highlights the potential of coupling programmable nucleic acids with liquid crystals to develop versatile platforms for biosensing and molecular diagnostics.



Schematic graphic of the LC-aqueous aptasensor

References

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